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MILLING, BAKING, AND CHEMICAL EXPERIMENTS WITH HARD RED SPRING WHEATS, 1945 CROP

by

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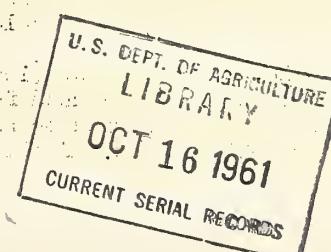
INTRODUCTION

Samples of the standard varieties and some of the new hybrid strains of hard red spring wheat, grown in cooperative experiments in the spring-wheat region<sup>2</sup> of the United States, are milled each year by the United States Department of Agriculture and the flour baked into bread to determine their quality characteristics.

1/ Cooperative investigations of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, and the Grain Branch, Production and Marketing Administration. The samples were obtained from the cooperative experiments with the State Agricultural Experiment Stations in the spring wheat region.

2/ Clark, J. A. Results of spring wheat varieties grown in cooperative plot and nursery experiments in the spring-wheat region in 1945, with averages for 1938 to 1945. U. S. Dept. Agr., Agr. Res. Admin., Bur. Plant Indus., Soils and Agr. Engin., Div. Cereal Crops and Dis. 42 CC, 49pp. February 1946. [Processed.]

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The baking methods and techniques used on the 1945 crop were essentially the same as used in testing the wheat varieties and hybrid strains from the 1944 crop. The bread-baking tests for the 1944 and 1945 samples were made by a rich highly bromated formula. One of the regular baking methods (No. 6) used for the 1939 to 1943 crops was continued for the 1944 and 1945 experiments. A selected group of hard red spring and hard red winter wheats comparatively grown at Sheridan, Wyo., were again tested for their response to bromate. This is the fifth year such samples have been collected and tested. As in past seasons, the Minnesota and North Dakota laboratory methods were used only on the seven uniform varieties of both the Eastern and Western composites from the region.

In addition, commercial wheat samples from cars grading No. 3 or better were obtained from terminal markets by the Grain Branch, Production and Marketing Administration, for comparison with varietal samples grown in plot and nursery experiments at agricultural experiment stations.

The purpose of this report is to make available to cooperators the quality data from the 1945 crop obtained from standard varieties, new hybrid strains, and Federal supervision grade samples of hard red spring wheat, together with a summary of previous years' results.

#### SOURCE OF SAMPLES

The most extensive tests (8) were made on the Eastern and Western composite samples of each of seven uniform varieties grown in plots at cooperating stations. The bread-baking test (employing a rich highly bromated formula) was made on the variety samples from plots grown at Madison, Wis.; St. Paul, Waseca, Morris, and Crookston, Minn.; Fargo, Langdon, Mandan, Edgeley, Williston, and Dickinson, N.Dak.; Brookings and Newell, S. Dak.; Havre and Moccasin, Mont.; Sheridan and Laramie, Wyo.; and Akron, Colo. Similar tests were made on samples of new wheats grown in single increase plots (1944-1945 Arizona increases) grown at Langdon and Dickinson. Similar tests were also made on Eastern and Western composites of the 26 strains grown in Uniform Regional Nurseries, composite samples from N. Dak., and Montana Intra-State Nurseries and from Langdon and Dickinson, N. Dak., station nurseries.

There were also included 15 samples composited from sampling of carlot receipts of wheat accumulated during a 90-day period of the 1945 crop movement by the Minneapolis, Duluth, and Great Falls, office of the Grain Branch, Production and Marketing Administration. These samples represent country-run wheat of the hard red spring class and were graded under the provisions of the U. S. Grain Standards Act as No. 3 or better. These samples are hereafter referred to as commercial samples. This is the seventh season that such samples have been collected and tested.

#### METHODS USED IN THE MILLING AND BAKING TESTS

The samples were cleaned for milling by the means of a small milling separator (equipped with sieves and air blast), and a scouring machine. The wheats were tempered in two stages; first to 14 percent for 48 hours and then additional amounts of water added 1/2 hour previous to milling, raising the moisture content of the grain to between 15.0 and 16.5 percent depending upon the hardness of the variety. The hardness of the variety was determined by the means of a Strong-Scott barley pearly. The wheat was milled on an Allis-Chalmers experimental flour mill provided with three break rolls and one smooth roll. A 90 percent patent flour was made discarding the low grade.

Baking tests on all of the 1945 varietal samples were conducted by the straight-dough procedure using the commercial-bromate-malted wheat flour formula (No. 6) supplemented by potassium bromate, the amount being varied to produce an optimum or maximum loaf volume.

The No. 6 baking test (including .001 percent, or 1 milligram of bromate per 100 grams of flour) used for the 1939, 1940, 1941, 1942, and 1943 samples and is sometimes referred to as the rich dough method was continued along with the other baking tests, of the samples from the 1944 and 1945 crop.

This baking procedure is based on the method of the American Association of Cereal Chemists, with certain modifications deemed necessary for unbleached experimentally milled flour. Because of the size of the mixing bowl, ingredients sufficient for two loaves were mixed at one time. They were mixed a sufficient length of time to develop the dough properly in a Hobart-Swanson dough-mixer (108 R. P. M.) with 4 pins in the head and 2 pins in the bowl. The absorption of the flour was calculated from the amount of water added for proper consistency at the time the doughs were mixed. The absorption values are indicated in the tables. When mixed, the doughs were divided, then rounded in the hands and placed in fermentation granite-ware "oatmeal" bowls, measuring 6 inches top diameter, 3 inches bottom diameter, and 2-1/2 inches deep. The punches were made by folding the dough approximately 10 times in the hands. At the end of the fermentation period the dough was rolled by a Thompson mechanical roll type "A" noulder with rolls set at a clearance of 3/8 of inch and the compression plate 1-1/8 inches. The rolled doughs were placed in baking pans constructed from 2XX tin known as the tall form. The proofing time of 55 minutes, at 86° F. and baking time of 25 minutes at 450° F. were the same for all samples. Two loaves of each sample were baked but since the ingredients were mixed as for one loaf, the two are not duplicates in the sense in which that term is usually used and are not so considered herein. Data given in the tables are averages of the two loaves.

The baking method (No. 1) which had been used on all samples starting with the 1929 crop was discontinued in 1942, as it produced much lower volumes than the other baking methods used on the 1942 and the previous crops. The commercial method (No. 2) was added in 1935 and in 1936 the commercial-bromate (No. 3). For a part of the samples in 1937, the basic, commercial and commercial-bromate bakes were made. In 1938 the same bakes as reported in 1937 were made and in addition the (No. 4) malt-phosphate-bromate. In 1939, the No. 4 method, which had been found to be unsatisfactory under our conditions, was replaced by the commercial-bromate-malted wheat flour (No. 6) test. The commercial-bromate-malted wheat flour (No. 6) test was first used for part of the 1938 samples and has been continued for all of the 1939, 1940, 1941, 1942, 1943, and 1944 samples. The No. 2 and No. 3 methods were discontinued in 1944 for most tests because they gave poorer volumes than the No. 6 method.

Starting with the 1944 samples additional baking tests were made varying the amounts of bromate (0 to 4 mg. per 100 grams of flour) with the commercial bromate-malted-wheat flour (No. 6) formula. With this baking procedure the optimum or maximum loaf volume is apparently obtained with the flour from each variety or strain. It has generally been found that the loaf having the optimum volume also has the best crumb color and grain-texture of the different baking tests made. The No. 6 test appears to bring out the full strength of the wheats somewhat better than the methods previously used. In actual practice a baking test with 1 milligram (No. 6) and 2 milligrams of bromate is made on the same day. Bakes with no bromate or increased amounts of bromate (.003 grams or higher) are made on the following days until the optimum loaf volume has been determined for each variety or strain. Average volumes are calculated from the three best bakes, only. This baking procedure brings each of the samples to its optimum volume by making provision for adequate gas production by the employment of sufficient sugar and diastatic supplements, and sufficient oxidation by the use of increasing amounts of potassium bromate. This is the baking method used in the 1945 experiments.

The only special tests made in 1945 were on the Eastern and Western composites for the seven uniform varieties by the U.S.D.A., the Minnesota and North Dakota laboratory methods, and the bromate response tests first started on spring and winter samples from Sheridan, Wyo. The latter were made from grain samples milled on the Buhler mill.

Details of the methods used in 1945, with the various ingredients are shown in Table 1.

Table 1.--Baking methods used for samples of the 1945 crop

Ingredients	Baking method
	Commercial-bromate-nalated wheat flour
Flour (grams)	100.0
Yeast (grams)	2.0
Salt (grams)	1.5
Sugar (grams)	5.0
Potassium bromate (grams) 1/	.0 to .004
Malted wheat flour (grams)	.25
Nonfat dry milk solids (grams)	4.0
Shortening (grams)	3.0
Water absorption (percent)	Optimum
Mixing time (minutes)	Optimum for each variety
Fermentation time (minutes)	180

1/ 0, 1, 2, 3, and 4 mg.

Fermentation periods:

- 1st. punch after 105 minutes.
- 2nd. punch after additional 50 minutes.
- Mold after additional 25 minutes.
- Proofing time - 55 minutes.
- Baked 25 minutes at 450° F.

A check or standard flour for control purposes was included in the baking trials with each day's tests. The loaf volume for each bake with the standard flour (12.3 percent protein) and the date of the baking test are shown in the following tabulation:

Date	Volume (Cc.)	Date	Volume (Cc.)	Date	Volume (Cc.)	Date	Volume (Cc.)
Nov. 14	775	Feb. 6	752	Apr. 25	775	June 4	775
19	775	7	778	29	749	5	775
20	726	11	792	30	744	6	767
21	735	12	766	May 1	792	10	772
26	741	13	778	2	781	13	795
28	758	14	784	6	778	17	772
29	761	19	752	7	778	18	772
Dec. 3	803	Mar. 7	778	8	812	19	772
5	751	11	792	9	752	20	763
10	775	12	766	13	781	July 1	748
12	752	13	778	15	789	2	789
Jan. 2	741	Apr. 11	762	16	766	8	792
3	775	15	801	20	766	9	818
9	769	16	781	21	781	10	775
14	738	17	752	22	761	11	775
16	758	18	775	23	766	15	792
17	763	22	775	27	783	16	772
24	769	23	752	28	766	17	775
29	775	24	775	June 3	784	18	766
Total							
Average							
Standard Error							

771

17.2

### EXPERIMENTAL RESULTS

The results for the regular methods on plot and nursery composite and station samples are given in tables 2 to 7, for the comparison of the spring and winter varieties from Sheridan, Wyo., in table 8, for U. S. D. A., North Dakota, and Minnesota methods on seven uniform varieties in table 9. The results for the commercial samples are shown in table 10, and the correlation and regression coefficients for 14 varieties and strains and the commercial samples are shown in table 11. Summaries of the comparable 1945 samples are averaged in table 12 and 8-year results in table 13. These tables are largely self-explanatory. The highest ranking variety or strain with respect to each property is indicated by underlining.

Acre yields are included, where comparable, to assist in the interpretation of results. The test weights for most of the composite and station samples were satisfactory. The milling and chemical data in table 2 are not repeated for the other baking methods reported in table 9.

All test weights were determined in the laboratory on a dockage-free basis. The protein and ash contents are reported on a 14.0 percent moisture basis and the flour yield on a moisture-free basis.

Table 2.—Yield, milling, baking, and chemical results on the uniform varieties of hard red spring wheats grown at experiment stations, from the Eastern and Western composites of the 1945 crop and averages with former years.

Section and Variety	Acre Yield	Bu. Lbs.	Test Weight	Wheat Flour Pct.	Flour Pct.	Protein Pct.	Baking Methods and Loaf Volume			Milling			Optimum Loaf Color			Grain texture Score		
							Milligrams of Bromate			Aver. 3 best			Wt. of Loaf Grams			Crumb Color		
							Mixing time	0	1	2	3	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	
Eastern Composite <sup>1</sup>																		
Newthatch	25.1	55.6	14.3	13.5	72.0	.44	64	2.5	801	892	908	818	873	908	146	83	88	
Cadet	27.7	57.0	13.6	12.8	71.8	.42	65	2.0	750	848	876	856	860	876	148	92	93	
Rival	30.5	56.0	13.3	12.2	74.2	.44	64	2.5	778	851	865	806	841	865	148	87	92	
Regent	25.5	56.3	13.6	12.8	72.0	.44	62	2.5	758	848	778	826	853	853	146	83	88	
Pilot	28.0	57.4	13.2	12.1	70.6	.42	62	2.5	806	842	818	763	822	842	148	88	88	
Thatcher	24.4	56.5	13.4	12.6	71.7	.42	62	2.5	769	833	839	775	816	839	143	87	88	
Mida	31.8	60.6	13.3	12.2	73.6	.41	62	2.0	795	824	812	781	810	824	151	92	90	
Average Range	27.6 7.4	57.1 5.0	13.5 1.1	12.6 1.4	72.3 3.6	.43 .03	63	2.4	776	849	852	797	835	858	147	87	90	
Western Composite <sup>2</sup>																		
Thatcher	20.3	55.3	15.6	14.7	71.3	.57	66	2.5	919	1015	986	913	973	1015	153	78	83	
Pilot	22.0	55.3	15.1	14.3	70.4	.43	64	3.0	942	1009	959	862	970	1009	148	85	87	
Cadet	19.9	55.1	15.6	15.0	71.6	.47	68	3.0	830	965	948	968	960	968	151	83	83	
Marquis	18.2	57.7	15.0	14.5	70.7	.45	63	2.5	830	905	959	981	918	959	147	88	85	
Newthatch	20.5	55.2	16.2	15.6	72.3	.53	65	2.5	818	956	939	862	919	956	151	77	82	
Ceres	20.4	58.0	15.4	14.8	71.5	.47	65	2.0	795	908	956	851	905	956	151	82	85	
Mida	23.6	59.0	14.6	13.7	73.4	.40	65	2.5	778	903	876	764	852	903	151	92	90	
Average Range	20.7 5.4	56.5 3.9	15.4 1.6	14.7 1.9	71.6 3.0	.47 .10	65	2.6	845	952	946	873	928	967	150	84	85	
Average Eastern and Western Composites																		
Newthatch	22.8	55.4	15.3	14.6	72.2	.49	65	2.5	810	924	924	840	896	932	149	80	85	
Thatcher	22.4	55.9	14.5	13.7	71.5	.50	64	2.5	844	924	913	844	895	927	148	83	86	
Pilot	25.0	56.4	14.2	13.2	70.5	.43	63	2.8	874	926	886	813	896	926	148	87	88	
Cadet	23.8	56.1	14.6	13.9	71.7	.45	67	2.5	790	907	912	912	910	922	150	88	88	
Mida	27.7	59.8	14.0	13.0	73.5	.41	64	2.3	787	864	844	773	831	864	151	92	90	
Average Range	24.3 5.3	56.7 4.4	14.5 1.3	13.7 1.6	71.9 3.0	.46 .09	65	2.5	821	909	896	836	886	914	149	86	87	

<sup>1</sup> From the Madison, St. Paul, Waseca, Morris, Crookston, Langdon, Edgeley, Brookings, and Lincoln stations.

<sup>2</sup> From the Dickinson, Williston, Havre, Moccasin, Sheridan, North Platte, Alliance, and Akron stations.

Table 2. --Continued

Section and Variety	Acre Yield Bu.	Composite		Protein		Flour		Baking Methods		Average Weight of Loaf Grams	Crumb Color Score	Grain texture Score
		Region	Yield Bu.	Test weight Lbs.	Wheat Pct.	Flour Pct.	Ash Fct.	Sorption Pct.	No. 6 Cc.			
Average 4 years, 1942 to 1945, inclusive												
Eastern Composite	26.0	29.0	57.1	14.9	14.1	71.0	.53	65	919	886	928	149
Newhatch	24.8	28.4	57.5	14.4	13.7	71.1	.52	68	893	864	916	152
Cadet	24.1	27.4	57.8	14.6	13.8	71.7	.52	63	895	865	915	148
Regent	27.2	30.7	58.3	13.7	12.6	70.5	.47	63	884	856	884	148
Pilot	27.0	30.4	58.4	14.0	13.1	73.1	.53	66	880	851	884	148
Rival	23.3	26.0	57.6	13.8	13.0	70.0	.54	64	877	845	883	148
Thatcher												
Average Range	25.4	28.7	57.8	14.2	13.4	71.2	.52	65	891	861	902	149
	3.9	4.7	1.3	1.2	1.5	3.1	.07	5	42	41	44	4
Average 8 years, 1938 to 1945 inclusive												
Western Composite	27.9	23.9	57.6	15.2	14.6	69.7	.54	66	928	883	928	151
Thatcher	29.3	24.5	57.3	14.8	14.1	68.8	.50	64	927	891	927	149
Pilot	26.5	23.5	59.1	15.0	14.3	69.6	.50	65	891	859	903	151
Ceres	27.7	23.3	57.1	15.2	14.7	71.5	.54	67	900	838	901	152
Cadet	23.3	20.1	58.1	14.6	14.0	68.5	.50	62	884	850	897	148
Marquis												
Average Range	26.9	23.1	57.9	15.0	14.3	69.6	.52	65	906	864	911	150
	6.0	4.4	2.0	1.6	0.7	3.0	.04	5	44	53	31	4
Average Eastern and Western Composites												
Cadet	26.3	25.9	57.3	14.8	14.2	71.3	.53	68	897	851	909	152
Pilot	28.3	27.6	57.8	14.3	13.4	69.7	.49	64	906	874	906	149
Thatcher	25.6	25.0	57.6	14.5	13.8	69.9	.54	65	903	864	906	150
Average Pilot Thatcher	26.2	26.1	57.4	15.1	14.2	69.5	.53	64	930	898	931	149
	24.4	24.4	57.2	15.1	14.6	69.9	.56	65	928	885	929	150

Table 3.—Yield, milling, baking, and chemical results for the leading hard red spring wheats grown in replicated "plots" in 1945.

Madison, Wis.

Variety or Coss	State or N. No.	C. I. No.	Acre Yield Bu.	Test weight Lbs.	Protein Pct.	Flour Pct.	Ab- sorp- tion Pct.	Baking Methods and Loft Volume						Average Score			
								Milligrams of bromate									
								Mix- ing time	0	1	2	3	4	Aver. best			
Regent			12070	33.8	56.0	14.5	13.9	73.2	.41	62.0	2.5	891	931	147	78	88	
Pilot			11945	36.0	55.1	14.7	13.5	72.0	.42	62.0	2.5	909	865	848	146	80	85
Newbatch			12316	33.3	55.5	15.5	14.6	72.3	.43	64.0	2.5	368	879	815	146	75	90
Cadet			12053	35.8	57.3	14.2	13.4	74.3	.45	67.0	2.5	873	859	821	854	879	87
Merit x Pilot		1764	12315	33.4	55.4	14.6	14.0	70.7	.50	65.0	2.5	856	856	786	851	873	149
Thatchor			10003	24.4	55.4	13.7	12.8	72.7	.44	62.0	3.0	853	824	795	833	856	146
Henry			12265	38.6	58.1	13.9	12.6	75.2	.40	62.0	2.0	839	847	833	824	853	73
Mida			12003	32.8	60.0	14.8	13.6	76.1	.43	63.0	2.0	839	815	795	840	847	72
Rival			11708	36.5	59.2	14.5	13.2	75.8	.41	65.0	2.5	821	770	726	770	821	83
H (137a-1-5-1-3)			12425	36.6	57.6	12.9	12.0	72.5	.38	62.0	3.5	761	795	720	759	795	88
Sturgeon			11703	37.0	60.0	14.7	13.5	71.3	.40	60.0	2.5	778	772	726	759	778	145
1151 x Pilot		1907	12366	34.6	60.0	15.0	13.7	71.2	.42	62.0	2.5	766	752	704	741	766	85
Pilot x Mida		1750	12316	37.2	60.9	14.4	13.4	72.9	.41	62.0	2.5	752	717	649	706	752	73
Average Range				34.6	57.7	14.4	13.4	73.1	.42	62.9	2.5	831	821	775	809	838	86
				14.2	5.8	2.6	2.6	5.7	.12	7.0	1.5	157	214	216	190	179	7

St. Paul, Minn.

Variety or Coss	State or N. No.	C. I. No.	Acre Yield Bu.	Test weight Lbs.	Protein Pct.	Flour Pct.	Ab- sorp- tion Pct.	Baking Methods and Loft Volume						Average Score			
								Milligrams of bromate									
								Mix- ing time	0	1	2	3	4	Aver. best			
Rival			11708	34.7	58.7	12.8	12.0	76.3	.62	70.0	3.0	818	806	795	806	818	154
Cadet			12053	36.4	56.7	12.7	11.9	72.1	.51	67.0	2.0	789	813	769	790	813	90
Henry			12265	40.3	58.0	12.3	11.1	75.3	.49	64.0	2.0	766	812	789	789	812	82
Thatchor			10003	33.7	56.5	13.1	12.2	71.8	.49	63.0	2.5	772	812	778	787	812	90
Newbatch			12318	34.1	56.1	13.2	12.5	74.1	.54	64.0	2.5	784	784	729	766	784	88
Regent			12070	29.6	56.7	12.7	11.8	72.6	.51	62.0	2.5	772	781	772	775	781	90
Pilot			11945	36.3	59.0	12.4	11.3	72.0	.49	66.0	2.0	752	766	763	760	766	88
H-44-M. x Thatchor		2761	12477	36.1	59.1	12.4	11.2	69.6	.48	64.0	2.5	726	763	681	723	763	87
H-44-M. x Thatchor		2762	12434	37.8	58.7	12.2	11.1	69.5	.46	65.0	2.5	744	761	698	734	761	90
H-44-M. x Thatchor		2760	12478	33.8	58.1	13.0	11.8	70.9	.44	63.0	3.0	729	749	729	736	749	88
Pilot x Mida		1756	12303	34.4	58.4	11.7	10.7	74.3	.48	65.0	2.0	696	741	620	686	741	85
Mida			120C8	38.9	60.8	11.9	10.7	74.3	.48	65.0	2.0	704	713	629	682	713	82
Merit x Pilot		1764	12315	38.8	58.5	11.6	10.4	69.9	.53	71.0	2.5	677	698	623	666	698	82
Mercury x Thatchor		M. 2757	12426	36.6	56.5	10.7	9.5	73.4	.52	66.0	3.0	686	674	649	670	686	83
Pilot x Mida		1750	12316	36.0	61.5	11.5	10.3	71.5	.49	66.0	2.0	612	637	623	624	637	82
Average Range				35.8	58.2	12.3	11.2	72.2	.50	65.3	2.4	725	745	745	734	756	83
				10.7	5.0	2.5	3.0	6.8	.18	9.0	1.0	175	190	13	182	181	8

Table 3.—Continued

Waseca, Minn.

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test weight	Protein	Flour yield	Ash	Baking Methods and Loaf Volume								Average		
								Milligrams of bromate				Absorption				Optimum		Average
								Min.	CC.	CC.	CC.	0	1	2	3	4	best	
Regent	12070	18.6	54.3	12.8	12.1	72.6	.58	62.0	2.5	818	875	862	852	875	150	77	87	
Newhardtch	12318	17.4	52.2	13.4	12.5	72.2	.57	64.0	2.5	786	836	807	810	836	152	78	85	
Pilot	11945	15.7	55.9	11.4	10.4	72.1	.45	63.0	2.5	815	833	781	810	833	150	78	85	
Thatcher	10003	17.8	55.9	12.6	11.8	73.4	.58	62.0	2.5	792	833	769	798	833	146	78	83	
H-44-M. x Thatcher	12477	16.5	56.4	13.0	11.9	71.7	.56	63.0	2.5	812	830	807	816	830	149	85	87	
Cadet	12053	18.5	54.3	12.7	11.8	70.8	.48	68.0	2.5	795	830	818	814	830	152	83	87	
H-44-M. x Thatcher	M. 2762	17.5	57.3	12.5	11.6	72.0	.52	64.0	2.5	755	821	795	790	821	150	85	83	
Mid. Mida	12008	21.0	59.2	12.2	11.2	75.7	.52	61.0	2.5	784	798	758	780	798	152	83	83	
Pilot x Mida	1756	12303	21.7	58.5	11.4	73.1	.50	63.0	2.5	772	775	761	769	775	151	83	83	
Merit x Pilot	1764	12315	20.3	57.0	11.4	71.4	.50	68.0	2.5	726	769	712	736	769	155	78	82	
Pilot x Mida	1750	12316	20.9	59.2	12.3	71.3	.57	65.0	2.5	767	763	761	764	767	151	83	83	
Rival	11708	19.3	58.4	11.9	10.9	74.8	.55	64.0	2.0	723	763	744	743	763	150	80	85	
Henry	12265	21.5	58.4	10.7	9.5	74.7	.43	60.0	2.5	732	755	728	738	755	150	75	82	
Mercury x Thatcher	M. 2757	12426	19.2	55.3	11.7	10.5	73.5	.56	65.0	3.0	730	755	726	737	755	153	78	83
Average Range			19.1	56.6	12.1	11.2	73.0	.53	64.0	2.6	782	796	783	803	151	80	84	
			4.3	7.0	2.7	3.0	4.3	1.3	7.0	1.5	104	147	116	120	9	8	5	

## Morris, Minn.

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test weight	Protein	Flour yield	Ash	Baking Methods and Loaf Volume								Average		
								Milligrams of bromate				Absorption				Optimum		Average
								Min.	CC.	CC.	CC.	0	1	2	3	4	best	
Regent	N. 2759	34.5	55.8	12.1	11.3	73.7	.50	60.0	3.5	792	836	827	818	836	150	88	93	
K. W.	12427	38.5	58.0	12.5	11.7	76.5	.47	64.0	2.5	772	815	784	790	815	150	88	93	
Mercury x Thatcher	N. 2757	40.3	56.4	12.5	11.5	74.7	.53	65.0	2.5	812	815	735	787	815	152	87	92	
H-44-Marquis x Thatcher	N. 2764	40.1	58.0	12.4	11.5	74.8	.47	63.0	2.5	803	812	750	788	812	149	87	92	
E-44-Marq. x Thatcher	M. 2762	39.4	58.3	12.5	11.5	75.0	.44	62.0	2.5	789	809	795	798	809	148	92	98	
Newhardtch	12318	32.1	55.3	13.1	12.3	73.6	.49	62.0	3.5	755	798	730	761	798	147	90	95	
Henry	12265	42.5	57.8	11.2	10.5	77.3	.46	62.0	3.0	772	795	750	772	795	152	87	93	
Thatcher	10003	31.7	55.8	12.5	12.1	72.3	.44	60.0	2.5	758	784	709	750	784	146	85	95	
Cedet	12053	36.2	57.2	12.3	11.3	73.3	.44	64.0	2.5	767	781	732	760	781	151	92	95	
Pilot x Mida	N. 1756	41.7	59.5	11.7	10.8	76.0	.41	62.0	2.5	704	752	750	735	752	149	87	90	
Merit x Pilot	N. 1764	41.5	57.7	12.3	11.4	72.5	.49	67.0	2.5	715	752	723	730	752	154	87	95	
Pilot x Mida	N. 1750	42.1	60.7	12.6	11.8	76.6	.43	64.0	2.5	674	747	692	704	747	152	87	96	
Mid. Mida	12068	42.2	59.6	12.1	11.2	77.3	.46	63.0	2.5	741	744	732	759	744	152	90	93	
Pilot	11945	37.4	57.1	12.7	11.5	72.9	.43	62.0	3.0	724	738	707	723	738	148	93	95	
Rival	11708	40.3	58.0	11.9	11.0	77.6	.51	62.0	2.5	726	732	712	723	732	150	95	95	
Average Range			38.7	11.4	12.3	11.4	74.9	.46	62.8	2.6	773	768		759	781	150	89	93
			10.8	1.8	1.4	1.8	5.3	.12	7.0	0.5	104	135		114	164	8	6	13

Table 3.—Continued

Crookston, Minn.

Variety or Cross	State or N. No.	C. I. No.	Acre weight Bu.	Protein:		Flour	Yield	Ash	Baking Methods and Loaf Volume				Wt. of Loaf	Crumb Color	Grain Texture	Average	
				Pct.	Pct.				Pct.	Pct.	Min.	Max.					
Merit x Pilot	1764	12315	36.5	54.0	14.6	13.3	69.4	.49	63	2.0	851	917	933	812	900	933	
Cadet	12053	29.8	55.0	14.3	13.3	70.3	.43	63	2.0	920	928	919	922	928	150	82	
Regent	12070	28.5	54.4	13.7	12.9	72.1	.47	62	2.0	842	913	903	886	913	147	88	
Newhatch	12318	27.4	53.8	15.2	14.5	72.0	.49	62	2.0	912	908	872	897	912	148	78	
Pilot x Mida	1750	12316	38.2	58.0	14.6	13.3	72.3	.39	60	2.0	850	889	836	858	889	152	82
Mercury x Thatcher	2757	12426	33.4	53.0	13.9	13.1	75.0	.45	62	2.0	836	874	885	856	872	885	87
Henry	12265	38.0	56.5	12.0	10.9	73.7	.40	60	1.5	815	827	845	786	829	845	77	
Mida	12008	35.1	58.3	13.8	12.8	74.3	.42	60	1.5	824	832	812	826	842	150	82	
Pilot x Mida	1756	12303	34.3	57.6	12.4	11.1	72.9	.39	60	1.5	784	809	783	792	809	150	85
Average Range			33.4	55.7	13.8	12.8	72.4	.44	61	1.8	861	871	865	865	884	149	87
Average Range			10.8	5.3	3.2	3.6	5.6	.10	3	.5	144	110	130	125	5	16	85
																10	

## Fargo, N. Dak.

Rival x Thatcher	S.D.280	12273	26.6	60.8	14.9	14.3	75.0	.37	65	3.0	930	972	911	934	972	149	35	92
2744 x 2822 x Prem.	Ns.3175	12440	28.7	61.1	15.1	14.3	73.1	.42	68	2.0	879	959	916	918	959	152	92	
2744 x 2809	Ns.3095	12359	28.3	60.9	15.1	14.6	74.4	.44	66	2.0	856	928	859	881	928	153	90	
Regent	12070	24.0	59.0	15.1	14.7	71.6	.40	66	2.5	914	925	899	913	925	152	88		
Newhatch	12480	28.9	59.7	14.6	14.0	74.7	.38	68	2.5	909	905	922	896	912	922	153	92	
2744 x 2809	Ns.3149	12318	23.1	58.5	14.9	14.8	74.1	.49	65	2.0	856	920	922	899	922	150	88	
Renown	11947	23.9	61.0	14.0	13.4	73.5	.44	63	2.5	876	908	909	898	909	149	88		
Mida	12008	27.7	61.2	13.8	13.3	73.3	.40	66	2.0	885	885	905	876	892	905	151	92	
Pilot	11945	26.8	59.0	13.4	12.4	72.2	.41	64	2.0	886	905	870	887	895	905	150	92	
Premier	1764	23.1	60.9	14.3	14.2	73.7	.45	70	2.5	892	899	902	898	902	155	93		
Rival x Pilot	11708	27.8	60.9	13.9	13.3	74.2	.50	67	2.0	851	892	890	878	892	152	93		
Ceres x H.T.F.	1556	12263	28.1	61.1	13.9	13.3	71.2	.36	67	2.0	833	882	880	866	882	153	97	
Pilot x Mida	1756	12303	26.8	61.3	13.3	12.6	74.2	.36	69	2.5	848	868	850	855	868	154	93	
Thatcher	10003	26.7	60.0	13.9	13.5	71.7	.44	65	2.0	755	851	848	836	845	851	148	90	
Pilot x Mida	1750	12316	25.7	61.8	13.5	12.7	73.5	.40	66	2.0	818	821	827	784	822	827	151	88
Marquis	3641	23.0	58.2	11.6	10.7	69.3	.46	63	2.5	769	778	772	775	778	150	83		
Average Range			26.3	60.3	14.1	13.5	73.0	.42	66	2.3	875	893		884	901	152	91	90
Average Range			6.2	4.2	3.5	4.1	5.7	.14	8	1.0	190	194		161	194	6	19	8

Table 3.--Continued

Langdon, N. Dak.

Variety or Cross	State or N. No.	C. I. No.	Acre Yield Bu.	Test weight Lbs.	Protein Pct.	Flour Yield Pct.	Wheat Flour Pct.	Ab- sorp- tion Pct.	Baking Methods and Loaf Volume				Wt. of Loaf Cc.	Opt- imum Loaf Cc.	Crumb Color Score	Grain Texture Score			
									Milligrams of Bromate										
									Mix- ing time Min.	0 Cc.	1 Cc.	2 Cc.	3 Cc.	4 Cc.					
2744 x 2809	Ns. 3175	12440	43.0	60.9	14.9	14.0	75.5	.43	66	2.0	876	954	928	919	95.4	149	90	88	
Cadet	12053	36.2	58.7	14.0	13.3	72.6	.46	.67	2.5	833	897	910	885	910	152	92	87		
Regent x Pilot	1753	12317	37.3	59.7	13.2	12.3	72.8	.44	65	2.5	903	909	896	903	909	148	83	85	
Regent	12070	34.8	61.2	13.7	13.2	74.8	.45	.66	2.5	729	824	865	894	861	894	155	82	83	
Pilot	11945	34.2	58.8	13.3	12.3	73.3	.44	.62	2.5	830	888	845	854	888	149	87	90		
Mida	12008	42.3	62.5	14.5	13.2	78.1	.45	.67	2.5	850	885	870	868	885	156	92	87		
Newhatch	12318	32.8	59.5	14.0	13.5	74.2	.45	64	2.0	788	879	842	836	879	150	80	87		
Rival	11708	39.7	60.9	14.0	13.2	78.1	.49	.65	2.0	815	862	876	859	866	876	152	88	90	
Merit x Pilot	1764	12315	36.7	58.0	13.3	12.6	73.0	.44	66	2.5	771	833	868	848	850	868	151	88	90
Premier	11940	36.0	62.0	14.1	13.4	76.6	.44	.67	2.0	809	862	827	833	862	153	93	90		
Renown	11947	32.5	62.0	13.2	12.4	74.6	.46	64	2.0	789	848	847	828	848	152	82	87		
Thatcher	10003	33.5	60.4	13.1	12.7	74.5	.42	62	2.0	775	836	821	811	836	148	83	85		
GDC x Mercury	Ns. 2975	12300	36.8	60.8	13.2	12.1	78.4	.44	66	2.0	761	824	807	797	824	154	83	87	
Pilot x Mida	1750	12316	39.7	63.0	13.5	11.8	75.3	.47	63	2.0	769	812	812	798	812	150	92	87	
Pilot x Mida	1756	12303	44.7	62.6	13.0	12.1	74.7	.39	63	2.0	732	795	789	772	795	149	88	83	
Average Range			37.3	60.7	13.7	12.9	75.1	.45	65	2.2	806	860	845	845	869	151	87	87	
			12.0	4.3	1.9	2.2	5.8	.10	5	2.5	142	165	147	147	147	8	13	7	

## Edgeley, N. Dak.

Thatcher	Newhatch	Cadet	Regent	Pilot	Rival	Mida	Baking Methods and Loaf Volume				Wt. of Loaf Cc.	Opt- imum Loaf Cc.	Crumb Color Score	Grain Texture Score				
							Milligrams of Bromate											
							Mix- ing time Min.	0 Cc.	1 Cc.	2 Cc.								
10003	16.4	56.1	13.9	13.4	73.9	.45	60.0	2.5	854	879	850	861	879	147	83	92		
12318	19.0	56.6	13.9	13.4	75.7	.45	62.0	3.0	763	870	842	825	870	146	77	87		
12053	24.6	58.6	13.7	13.2	74.2	.43	63.0	3.0	795	850	815	820	850	147	93	92		
12070	20.2	58.7	13.4	13.0	73.9	.44	62.0	3.5	804	836	758	799	836	146	80	87		
11945	23.8	59.3	13.4	12.3	75.5	.38	60.0	2.5	778	830	789	799	830	147	88	92		
11708	29.2	60.3	13.6	12.8	77.8	.45	63.0	3.5	747	792	786	775	792	149	85	88		
12008	24.8	61.9	12.7	11.9	77.1	.40	60.0	3.0	701	752	746	733	752	148	90	88		
Average Range	21.1	58.8	13.5	12.9	75.2	.43	61.4	2.9	814	818	802	830	147	85	89	89		
	12.8	5.8	1.2	1.5	4.3	.07	2.0	1.0	118	135	128	107	3	13	5	5		

Table 3.--Continued

Williston, N. Dak.

Variety or Cross	State No. or N. No.	C. I. No.	Acre Yield	Test Weight	Wheat	Flour	Protein Pct.	Flour Pct.	Wheat Flour Yield	Ash	Absorption Pct.	Mixing time	Baking Methods and Loaf Volume				Crumb Color	Grain texture	Average Score		
													0	1	2	3	Aver. 3 best				
Pilot	11945	22.6	55.1	16.4	15.3	68.3	4.9	62	2.5	1001	1001	1001	CC.	CC.	CC.	CC.	1099	148	88	88	
Rescue	SC. 4183	17.9	56.0	16.4	16.1	70.0	4.5	63	3.5	983	D24	600	CC.	CC.	CC.	CC.	1024	148	80	82	
Regent	12070	23.8	56.0	16.1	15.5	70.2	4.4	64	2.5	968	D15	940	CC.	CC.	CC.	CC.	1015	150	85	87	
Newthatch	12318	23.9	55.0	17.4	16.8	70.0	5.2	64	2.0	963	1009	969	CC.	CC.	CC.	CC.	1009	149	80	87	
Cadet	12053	22.9	54.5	16.1	15.3	68.0	4.4	67	2.5	903	992	697	CC.	CC.	CC.	CC.	992	153	93	93	
Thatcher	10003	23.2	54.5	17.3	16.3	70.6	5.2	65	2.0	856	980	853	CC.	CC.	CC.	CC.	896	147	90	85	
Merit x Pilot	12315	20.4	55.6	16.8	16.2	67.7	5.8	70	3.0	951	971	933	CC.	CC.	CC.	CC.	971	154	92	88	
Ceres	6900	24.7	58.5	15.8	15.2	68.8	4.5	56	3.0	885	948	833	CC.	CC.	CC.	CC.	889	152	88	87	
Mida	12008	21.7	59.3	15.2	14.5	72.3	4.2	64	2.5	871	942	898	CC.	CC.	CC.	CC.	904	152	93	90	
Rival	11708	23.4	57.4	15.2	14.2	72.4	4.1	51	67	3.5	908	928	815	CC.	CC.	CC.	CC.	928	150	90	90
Vesta	11712	21.5	57.6	15.7	15.1	72.0	4.5	64	3.5	859	882	778	CC.	CC.	CC.	CC.	882	152	95	90	
Average Range			22.4	56.3	16.2	15.6	70.2	4.8	65	2.8	923	981	869	CC.	CC.	CC.	CC.	924	150	89	88
			6.8	4.8	2.2	2.6	4.7	1.6	8	1.5	145	217	191	CC.	CC.	CC.	CC.	143	217	15	11

Dickinson, N. Dak.

Variety or Cross	State No. or N. No.	C. I. No.	Acre Yield	Test Weight	Wheat	Flour	Protein Pct.	Flour Pct.	Wheat Flour Yield	Ash	Absorption Pct.	Mixing time	Baking Methods and Loaf Volume				Crumb Color	Grain texture	Average Score		
													0	1	2	3	Aver. 3 best				
C. x H.T.F.	1556	22.4	61.8	15.6	14.4	73.8	4.2	68	2.0	848	959	960	1010	1010	1010	1010	1010	154	98	87	
Rival	11708	24.3	61.0	14.5	13.6	75.8	4.7	69	2.5	919	1010	992	CC.	CC.	CC.	CC.	1010	151	85	90	
Newthatch	12318	17.0	61.2	15.3	15.0	75.0	4.0	40	2.0	922	971	962	CC.	CC.	CC.	CC.	971	149	83	87	
Regent	12070	17.9	62.0	14.0	14.4	75.0	4.1	41	66	2.0	876	906	957	CC.	CC.	CC.	CC.	957	151	85	88
Pilot	11945	19.1	60.2	14.0	12.8	71.7	3.0	66	2.0	917	937	891	CC.	CC.	CC.	CC.	915	150	88	90	
Merit x Pilot	12362	20.4	60.7	14.9	14.1	73.5	4.6	69	2.0	854	934	913	CC.	CC.	CC.	CC.	900	153	90	88	
2744 x 2809	3175	20.3	62.0	14.9	13.7	73.9	4.6	69	2.5	869	922	933	CC.	CC.	CC.	CC.	918	150	90	88	
Mida x Cadet	1831	12363	20.6	60.5	13.6	13.1	77.5	4.3	67	2.0	894	923	931	CC.	CC.	CC.	CC.	911	922	153	80
1556 x 1563	1840	23.6	61.2	14.4	13.5	77.8	3.7	68	2.5	909	920	908	CC.	CC.	CC.	CC.	912	150	90	85	
Merit x Pilot	1764	12315	16.9	60.2	14.4	13.7	73.0	4.7	68	2.5	868	911	914	CC.	CC.	CC.	CC.	898	151	85	85
Regent x Pilot	1753	12317	22.2	62.0	13.6	12.4	72.0	3.9	67	2.0	871	913	845	CC.	CC.	CC.	CC.	876	149	83	87
Regent x Mida	1843	10003	20.0	61.2	14.2	13.7	74.1	4.0	64	2.0	818	901	896	CC.	CC.	CC.	CC.	872	149	83	87
Cadet	12430	20.3	62.0	14.5	13.5	76.2	5.0	66	2.0	859	897	892	CC.	CC.	CC.	CC.	887	151	88	90	
Vesta	12053	20.2	60.5	14.0	13.2	72.4	4.4	68	2.0	848	894	885	CC.	CC.	CC.	CC.	876	155	90	92	
C.D.C. x Mercury	2975	11712	21.7	62.6	14.1	13.4	77.4	4.3	66	3.0	807	892	874	CC.	CC.	CC.	CC.	858	150	90	90
Mida x Cadet	1835	12300	24.4	61.4	13.6	12.3	76.8	4.5	67	2.0	807	871	847	CC.	CC.	CC.	CC.	842	152	78	85
Merit x Pilot	12441	20.2	62.3	13.5	12.7	76.9	4.4	66	2.0	856	865	856	CC.	CC.	CC.	CC.	859	150	90	85	
Ceres	12364	19.3	61.5	14.2	13.4	72.7	4.7	70	3.0	856	865	821	CC.	CC.	CC.	CC.	847	151	87	88	
Pilot x Mida	1756	12303	21.0	62.2	14.1	13.3	72.7	4.1	67	3.0	839	853	853	CC.	CC.	CC.	CC.	848	151	85	90
1552 x Mida	1924	12482	27.9	62.7	13.5	12.7	75.5	3.5	65	2.0	806	845	821	CC.	CC.	CC.	CC.	824	152	92	92
R.H. x C.H.F.	1520	12050	19.5	62.9	13.2	12.2	75.9	3.9	65	2.0	792	842	833	CC.	CC.	CC.	CC.	818	154	92	85
Marquis	3641	18.1	61.4	13.5	12.7	71.4	4.1	66	2.0	775	837	833	CC.	CC.	CC.	CC.	805	152	82	90	
Mida x Mida	1750	12308	25.0	63.4	14.3	13.3	73.8	3.9	66	2.0	809	833	818	CC.	CC.	CC.	CC.	829	155	92	88
Average Range			20.7	61.7	14.2	13.3	74.5	4.2	67	2.0	856	891	879	CC.	CC.	CC.	CC.	879	151	86	88

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Table 3.—Continued

Brookings, S. Dak.

Variety or Cross	State or N. No.	T. C. I. No.	Acre Yield	Test Weight	Protein Pct.	Flour Pct.	Ab-sorption Pct.	Baking Methods and Loaf Volume				Average						
								Milligrams of Bromate	0	1	2	3	4	Optimum	Wt. of Loaf	Crumb Color	Grain Color	Grain texture Score
			Bu.	Ibs.	Pct.	Pct.	Pct.	Min. cc.	cc.	cc.	cc.	cc.	cc.	cc.	cc.	cc.	cc.	
Mida		12008	42.8	59.0	14.3	13.8	71.5	49	2.5	953	1015	939	269	1015	147	80	80	
Rival x Thatcher	SD2259	12272	42.2	57.2	14.7	14.0	74.2	49	63	3.0	862	968	850	893	968	150	92	90
Newbatch		12318	26.2	51.6	15.3	14.5	69.8	48	64	2.0	934	945	934	938	945	147	85	87
Pilot		11945	32.7	56.2	14.4	13.2	70.7	44	62	2.0	888	931	881	900	931	148	95	90
Regent		12070	26.9	54.1	14.5	13.3	74.2	50	62	2.0	885	923	910	906	923	150	93	85
Cadet		12053	30.6	55.4	14.3	13.6	69.5	50	65	2.5	903	914	902	906	914	150	95	90
Thatcher		10003	24.0	54.0	13.8	13.0	70.8	43	62	2.5	876	903	859	879	903	144	90	88
Merit x Pilot	M1764	12315	38.0	56.0	14.0	13.2	69.2	50	68	2.5	786	881	845	837	881	152	90	87
Henry		12265	40.1	58.1	13.2	12.1	74.4	49	60	2.5	854	879	865	866	879	146	82	87
Pilot x Mida		12303	45.1	60.1	13.2	12.4	74.1	43	62	2.0	827	859	764	817	859	146	90	88
Rival x Thatcher	SD2280	12273	37.9	57.8	13.9	13.2	74.8	54	62	2.5	744	845	784	791	845	148	82	87
Rival		11708	40.3	58.0	13.7	12.9	74.9	48	64	2.5	836	839	792	822	839	150	92	90
Average Range			35.6	56.5	14.1	13.3	72.3	47	63	2.4	879	900	800	877	909	148	89	87
Range			21.1	55.8	2.1	2.4	5.7	0.7	8	1.0	125	231	231	152	176	148	15	10

Newell, S. Dak.																		
E.H. x C.R.H.	1520	12050	25.5	56.5	13.6	12.5	70.2	51	61	2.0	815	818	761	798	818	153	85	88
Newbatch		12318	21.8	56.3	13.7	13.3	72.7	54	62	2.5	818	812	750	793	818	145	90	88
Cadet		12053	21.6	55.1	13.6	12.0	69.2	55	63	2.0	741	798	778	772	798	151	93	90
Mida		12008	24.7	60.1	12.1	11.2	74.8	49	63	2.0	755	744	741	747	755	151	97	88
Thatcher		10003	25.6	58.0	11.9	11.0	71.8	54	62	2.0	718	741	671	710	741	146	87	87
Regent		12070	22.1	59.1	11.7	10.9	71.6	49	62	2.0	617	732	703	684	732	148	82	85
Rival x Thatcher	SD2280	12273	22.8	59.7	11.9	11.2	76.5	49	60	2.5	669	717	707	698	717	150	83	88
Merit x Pilot	1764	12315	27.0	58.9	11.6	10.8	75.5	58	67	2.0	713	715	683	704	715	154	90	85
Pilot x Mida	1756	12303	24.2	59.4	11.2	10.3	74.9	54	60	2.0	693	683	671	684	693	150	93	92
Marquis		3641	21.5	59.5	10.4	9.4	71.0	47	60	2.5	660	689	629	659	689	152	88	85
Ceres		6900	23.4	58.9	10.3	9.2	70.2	47	60	2.5	615	623	589	609	623	152	78	78
Pilot		11945	23.2	58.0	9.9	8.5	70.5	46	58	2.5	583	600	577	587	600	150	85	78
Average Range			23.6	58.3	11.8	10.9	72.4	51	62	2.2	716	711	688	704	725	150	88	86
Range			16.5	55.0	13.8	4.8	7.1	12	9.5	5	232	218	9	211	218	14	15	10

Table 3.—Continued

Havre, Mont.

Variety	State or Class	C. I. No.	Acre Test Bu.	Yield Lbs.	Weight Wheat Pct.	Protein Pct.	Flour Pct.	Ab- sorp- tion Pct.	Mix- ing time	Ash time	Baking Methods and Loaf Volume			Wt. Opt- imum best	Crumb Loaf C. C.	Grain Color C. C.	Score Score	
											1	2	3	Aver.				
Pilot x Thatcher	11045	11.6	52.7	18.7	18.7	17.1	67.9	67	2.0	1069	1178	1027	1101	1178	147	78	80	
Cadet	10003	12.4	52.5	18.4	17.8	17.6	69.6	48	2.5	1169	1169	1068	1084	1148	157	77	77	
Marquis	12053	11.9	52.8	18.0	18.4	17.3	67.3	48	2.5	965	1110	1101	1059	1110	149	72	78	
Merit x Pilot	3641	12.2	56.0	18.2	18.0	18.0	68.4	48	2.0	1021	1096	1081	1066	1096	149	78	82	
Pilot x Mida	12315	10.2	55.4	18.0	17.9	17.2	68.0	52	2.5	934	1055	1012	1000	1055	152	88	85	
Ceres	12303	11.3	55.9	17.7	17.7	16.7	68.4	42	2.0	974	1032	1050	983	1022	148	83	83	
Rescue	6900	12.1	56.3	17.6	17.6	16.8	69.5	47	2.5	1021	1044	1018	1028	1044	150	82	80	
Mida	SC4188	12435	11.2	58.2	16.7	16.3	70.9	47	2.5	1024	1038	1021	1028	1038	148	82	82	
Newhatch	12008	12.2	57.2	17.3	16.3	71.7	46	2.0	907	997	905	936	997	150	88	87		
Comet x 1018	12318	10.9	54.2	18.0	17.4	17.4	71.7	50	2.0	954	992	959	968	992	150	75	82	
R.H. x C.R.H.	1315	12060	12.7	53.7	16.5	15.6	68.6	40	2.5	905	948	905	919	948	150	83	85	
Average Range				11.5	54.9	17.8	69.2	46	2.3	974	1049	1004	1008	1051	149	80	82	
Moccasin, Mont.																		
Rescue	12435	13.5	55.9	17.2	16.9	68.3	44	62	3.0	911	1075	954	980	1075	147	80	83	
Pilot	11945	16.1	53.5	17.6	16.6	66.1	43	65	3.0	1064	1064	889	1006	1064	146	88	90	
Cadet	12053	13.6	54.1	18.1	17.1	67.6	48	68	2.5	911	1015	974	967	1015	153	87	87	
Pilot x Mida	12303	15.6	58.1	16.8	16.0	69.8	38	64	2.5	962	1044	933	966	1004	149	92	90	
R.H. x C.R.H.	1520	12343	15.5	56.3	16.5	16.8	68.7	40	2.5	934	992	870	932	992	151	85	83	
Thatcher	10003	16.1	55.2	17.4	16.5	66.8	43	66	2.5	968	980	934	961	980	148	82	83	
Merit x Pilot	1764	12315	16.4	54.4	16.8	16.3	67.8	54	69	3.5	879	977	937	931	977	154	92	90
Newhatch		12328	16.4	54.4	17.4	16.8	71.0	46	66	2.5	886	951	912	916	951	148	80	87
Ceres	6900	16.2	57.0	16.5	15.8	68.2	44	66	3.0	809	934	928	890	934	150	85	88	
Mida	12008	15.4	58.3	16.4	14.7	71.1	39	64	2.5	874	893	839	869	893	151	93	92	
Pilot x Mida	1750	12316	14.3	58.5	16.3	15.3	68.9	42	64	2.5	800	883	868	850	883	150	90	85
Comet x 1018	1315	12060	16.5	55.0	15.6	14.7	67.6	38	67	2.5	859	882	824	855	882	151	85	88
Comet x Pilot	1585	12073	15.3	55.7	16.3	15.5	67.7	39	66	3.5	859	879	836	858	879	150	75	87
Average Range	15.5	55.9	16.8	16.0	16.4	43	66	2.8	1.0	917	962	77	922	964	150	86	87	
	3.0	4.8	2.7	2.4	5.0	16	7	1.0	1.0	205	207	156	196	156	18	9	9	

Table 3.—Continued

## Sheridan, Wyo.

Variety or Class	State or N. No.	C. I. No.	Acre Yield Bu.	Test- Weight Lbs.	Protein Pct.	Flour Pct.	Wheat Flour Pct.	Yield Ash	Baking Methods and Loaf Volume				Average						
									Milligrams of Bromate				Aver.						
									Pet.	Pet.	Pet.	Pet.	Min.	Min.	0	1	2	3	
Ceres	6900	32.0	54.7	15.5	14.9	69.9	.55	.55	65.0	2.0	868	939	908	905	939	150	82	88	
Pilot x Mida	12324	30.0	54.6	15.1	14.5	70.6	.50	.50	62.0	2.0	800	922	908	877	922	145	83	92	
Marquis	3641	31.4	54.3	15.8	15.1	67.7	.53	.53	64.0	2.0		919	916	905	913	919	149	83	90
Merit x Pilot	1860	12355	33.2	54.7	14.6	13.8	.71.2	.65	64.0	2.0		359	903	889	884	903	147	87	90
Cadet	12053	23.2	53.0	15.7	15.2	70.5	.60	.60	66.0	2.0		865	903	881	883	903	150	83	85
Thatcher	10003	31.5	53.3	15.5	14.7	69.3	.55	.55	65.0	2.0		827	903	812	847	903	146	83	90
Newthatch	12318	29.3	52.3	15.8	15.2	68.5	.58	.58	66.0	2.0		821	901	862	861	901	147	82	88
Merit x Pilot	1764	12315	36.2	53.3	16.3	15.3	68.8	.64	66.0	2.0		809	891	868	856	891	151	83	90
Pilot x Merit	1827	12352	52.5	55.2	14.6	13.5	71.9	.53	64.0	2.0		793	879	836	838	879	148	90	90
Merit x Pilot	1652	12275	35.8	55.5	14.5	13.6	69.5	.60	68.0	2.0		722	868	842	811	868	153	90	90
Regent x Pilot	1753	12317	35.0	55.7	13.5	12.7	70.5	.56	67.0	2.0		795	864	803	817	854	148	80	88
Mida x Cadet	1752	12321	33.0	56.8	14.2	13.6	71.4	.49	64.0	2.0		721	854	842	806	854	149	82	88
Mida x Cadet	1831	12363	37.1	57.0	13.9	13.0	72.9	.48	62.0	2.0		845	845	809	833	845	146	87	90
Comet-1110 x H4 Ceres	1586	12276	35.9	56.4	13.3	12.6	73.3	.49	64.0	2.0		818	839	758	805	839	150	82	85
Merit x Pilot	1792	12362	39.6	55.3	14.7	13.9	71.3	.62	65.0	2.0		789	836	821	815	836	150	85	87
Pilot x 1315	1829	12353	36.3	53.5	14.6	13.6	70.4	.45	62.0	2.0		801	830	815	815	830	147	83	87
1411 x Renown	1833	12361	32.7	56.0	14.6	13.4	72.6	.52	62.0	2.0		763	827	763	784	827	149	87	87
Mida x Cadet	1835	12441	37.9	57.1	13.5	12.5	72.4	.47	62.0	2.0		795	813	789	793	813	145	90	93
Mida	12008	33.7	58.6	13.7	13.0	74.1	.48	.48	66.0	2.0		753	809	738	768	809	150	87	88
Pilot x Mida	1756	12303	51.7	57.0	14.1	13.0	70.7	.46	62.0	2.0		781	801	772	785	801	149	90	88
Pilot 13	11945	37.3	57.1	12.3	11.2	71.4	.61	.61	62.0	2.0		720	801	711	744	801	148	80	87
Comet	11465	36.7	57.0	13.5	12.6	73.4	.47	.47	62.0	2.0		721	789	718	743	789	149	85	83
Comet x 1315	1315	12060	36.3	54.0	14.0	13.2	70.6	.46	65.0	2.0		775	786	766	776	786	154	83	87
Pilot x Mida	1750	12316	32.1	57.2	13.9	12.9	74.1	.58	66.0	2.0		761	783	710	751	783	152	85	83
Comet x Pilot	1585	12073	37.2	58.3	12.4	11.5	70.7	.45	62.0	2.0		663	643	615	640	663	151	73	78
Average Range			33.9	55.5	14.4	13.5	71.2	.53	63.9	2.0		842	809	814	846	846	149	84	88
			16.4	6.2	4.0	4.1	6.7	.20	6.0	0.0		296	301	273	276	276	9	17	15

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15  
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Table 3.--Continued

Laramie, Wyo.

Variety or Class	State or N. No.	C. I. No.	Acre Yield	Test Weight	Wheat Weight	Protein Pct.	Flour Pct.	Ab-sorption Pct.	Ash Pct.	Baking Methods and Loaf Volume						Average Score		
										Milligrams of Bromate								
										Min. Cc.	Max. Cc.	Aver. Cc.	Optimum Cc.	Wt. of Loaf	Crumb Color	Grain Texture		
Merit x Pilot	1764	12315	46.3	61.0	15.0	14.7	73.0	5.0	68	1.5	775	798	865	835	865	157	85	
Hope x Thatcher	II-31-2	12119	57.1	62.7	13.8	13.5	75.9	.41	.67	1.3	772	846	833	817	846	154	82	
Pilot	.....	11945	50.3	61.8	14.2	13.2	75.4	.45	.63	1.5	806	833	818	819	833	151	90	
Cadet	.....	12053	48.4	60.4	14.5	13.9	73.4	.49	.69	1.5	821	812	798	810	821	156	97	
Newthatch	.....	12318	48.7	61.7	14.2	13.9	76.6	.47	.64	1.5	759	818	815	797	818	151	85	
Mida	.....	12008	52.6	62.8	14.4	13.9	77.5	.48	.67	1.5	792	815	803	803	815	154	92	
Thatcher	.....	10003	48.8	62.2	13.3	12.9	77.1	.44	.62	1.5	301	815	786	801	815	150	92	
Pilot x Mida	1750	12316	45.0	63.2	14.2	13.1	73.4	.38	.61	1.3	763	721	689	724	763	152	90	
Ceres	.....	6900	40.1	60.8	12.2	11.7	73.8	.45	.70	2.0	707	730	666	701	730	159	78	
Marquis	.....	3641	32.6	58.4	11.3	10.5	72.2	.43	.22	1.7	646	646	609	634	646	155	83	
Comet	.....	11465	36.3	57.1	9.9	9.1	69.7	.42	.66	1.5	609	586	533	576	609	157	73	
Average Range	.....	46.0	61.1	13.4	12.7	74.3	.45	.65	1.5	758	746	756	756	778	154	86	87	
.....	24.5	6.1	5.1	5.6	7.8	7.8	12.9	12.9	12.9	260	300	259	259	256	9	24	20	
Akron, Col.																		
Converse	41.1	25.6	53.5	12.6	10.9	69.4	.42	.57	1.7	781	855	778	806	859	153	88	87	
Cadet	.....	12053	22.0	55.1	13.0	12.2	71.9	.47	.62	2.2	836	803	769	803	836	152	90	92
Pilot	.....	11945	21.5	53.3	13.0	11.9	70.9	.47	.58	2.5	736	787	733	782	836	151	83	88
Thatcher	.....	10003	16.1	54.6	13.2	12.2	70.4	.47	.58	2.5	764	730	738	751	784	144	83	87
Merit x Pilot	1764	12315	23.7	53.7	12.1	10.9	70.8	.52	.62	2.5	781	722	620	708	781	150	83	77
Newthatch	.....	12318	20.5	55.0	14.3	13.4	72.9	.47	.62	2.0	760	778	749	762	778	152	82	87
Florence	.....	6607	20.4	55.3	11.6	10.5	71.0	.40	.53	1.7	758	775	692	742	775	156	87	87
R.H. x C.R.H.	1520	12050	22.7	57.5	12.5	11.2	72.8	.39	.59	2.0	763	704	654	707	763	153	85	83
Mida	.....	12008	26.4	57.4	11.7	10.6	75.0	.43	.58	2.2	758	735	657	717	758	152	90	92
Reward	.....	8182	21.2	59.6	13.1	12.0	71.2	.39	.59	2.0	672	735	646	684	735	152	83	87
Ceres	.....	6900	20.7	56.1	12.5	11.2	72.3	.45	.59	2.2	735	668	629	677	735	151	80	82
Pilot x Mida	1750	12316	23.2	58.5	11.1	10.6	74.2	.44	.60	2.0	675	594	577	612	675	152	72	72
Marquis	.....	3641	20.8	57.6	11.9	10.8	71.6	.45	.57	2.0	652	663	615	643	663	155	83	87
Comet x Pilot	1585	12073	24.7	56.3	11.0	10.0	71.5	.38	.55	2.0	596	606	527	576	606	157	70	75
Average Range	.....	22.1	56.0	12.4	11.3	71.9	.44	.59	2.1	742	726	669	712	756	152	84	85	85
.....	10.3	6.3	3.3	3.4	5.6	14.7	8.8	240	265	251	230	253	13	20	20			

Table 4.—Yield, milling, baking, and chemical results for newer hard red spring wheats grown in single increase plots at three experiment stations in 1945.

Mandan, N. Dak.

Variety or Class	State or N. No.	C. I. No.	Acre Test Weight	Flour Pct.	Protein Pct.	Flour Pct.	Ab-sorption time	Baking Methods and Loaf Volume				Average			
								Milligrams of Bromate				Wt. of Loaf Color			
								Min. Cc.	Optimum Cc.	Aver. Cc.	best Cc.	Min. Cc.	Optimum Cc.	Aver. Cc.	best Cc.
Regent x Pilot	1952	12475	51.5	61.5	14.9	13.8	72.9	.38	.66.0	2.5	.960	983	977	.973	.982
Regent x 1582	1912	12446	40.5	61.3	15.9	15.0	73.6	.42	.64.0	2.0	.856	933	974	.938	.963
Mida x Pilot	1792	12362	51.5	60.7	15.4	14.7	74.3	.47	.67.0	2.5	.850	960	859	.890	.960
1615 x Pilot	1902		48.1	60.9	15.6	14.6	73.3	.44	.69.0	2.5	.911	957	905	.924	.957
1568 x Merit	1916		46.9	61.3	15.9	15.1	76.1	.36	.66.0	2.5	.859	956	894	.903	.956
Mida x Cadet	1835	12441	48.8	61.8	15.3	14.3	73.8	.37	.66.0	2.0	.879	948	876	.901	.948
1615 x Pilot	1918	12447	52.4	61.6	15.3	14.4	73.3	.34	.66.0	2.5	.928	933	853	.905	.933
Pilot x Merit	1984	12443	46.9	59.8	14.8	13.6	72.2	.34	.55.0	2.0	.879	925	883	.896	.925
Pilot x Mida	1953	12445	55.2	63.1	15.0	14.0	73.4	.33	.64.0	2.0	.856	911	895	.889	.911
Mida x 1529	1965		44.2	61.2	14.0	13.1	76.9	.36	.64.0	2.5	.890	906	807	.868	.906
1441 x Renown	1833		44.3	61.7	15.7	14.8	73.4	.36	.67.0	2.5	.901	905	804	.870	.905
Pilot x Merit	1898	12442	46.9	60.1	16.1	14.7	73.8	.41	.67.0	2.5	.889	889	886	.888	.889
Pilot x Mida	1964		53.4	61.2	14.5	13.5	76.8	.33	.64.0	2.0	.842	873	839	.851	.873
Thatcher	Check 10003	39.1	58.4	14.7	13.8	74.3	.42	.62.0	2.5	.833	862	830	.842	.862	
Pilot x Mida	1751		51.5	61.6	14.8	13.6	74.7	.44	.62.0	2.0	.845	848	812	.835	.848
Marcus	Check 3641	37.7	60.8	14.2	13.7	72.6	.38	.64.0	2.5	.747	839	830	.805	.839	
Average Range		47.2	61.1	15.1	14.2	74.1	.38	.65.2	2.3	.914	894		.886	.917	
		17.5	4.7	2.1	2.0	4.7	.14	.7.0	.0.5	.150	165		.167	.149	
													.10	.13	
														.7	

Langdon, N. Dak.

(Arizona Increases)

Pilot x 1514	2014	12476	62.0	14.5	13.6	73.8	.44	.67	2.0	.827	945	879	.884	.945	.152	.83	
Mida x 1529	2013		60.8	14.5	13.6	74.4	.41	.64	2.0	.862	876	775	.838	.876	.150	.77	
Regent x 1315	2018	61.0	14.5	13.4	73.0	.41	.62	2.0	.732	865	815	.804	.865	.146	.78	.87	
Pilot x Merit	1951		58.3	13.5	12.4	74.1	.44	.62	2.0	.755	859	830	.815	.859	.150	.80	.83
1567 x Merit	2016		59.4	13.6	12.9	73.4	.50	.66	2.0	.717	842	813	.791	.842	.143	.78	.87
1564 x Pilot	2017		60.8	13.7	12.6	74.0	.40	.64	2.0	.781	818	766	.788	.813	.147	.88	.87
Pilot x Merit	2012	12493	58.9	13.8	12.9	73.2	.46	.65	2.0	.689	815	801	.768	.815	.151	.78	.85
1614 x Cadet	2015		58.9	12.7	11.8	74.9	.42	.62	2.0	.755	804	764	.774	.804	.148	.82	.90
Pilot x Mida	1953	12445	60.5	13.2	12.0	75.3	.44	.64	2.0	.674	781	766	.740	.781	.150	.82	.85
Pilot x Mida	1759	12324	60.4	13.2	12.2	75.1	.41	.61	2.0	.748	772	753	.758	.772	.147	.87	.87
Average Range		60.1	13.7	12.7	74.1	.43	.64	2.0	.856	806		.796	.838	.149	.81	.87	
		3.7	1.8	1.8	2.3	.10	.6	0	.173	126		.144	.173	6	11	7	

Table 4.--Continued

Dickinson, N. Dak.  
(Arizona Increases)

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test Weight	Wheat Flour	Protein Pct.	Flour Pct.	Absorption Pct.	Ash Pct.	Baking Methods and Loaf Volume				Aver. Optimum Loaf Cc. Grams Score	Average
										Mixing time	Milligrams of Bromate	Fin. Cc.	Fin. Cc.		
1552 x Mida	2024		61.2	15.4	14.7	74.7	.42	.62	1.5	845	945	910	945	149	85
1552 x Pilot	2021		60.2	15.6	14.4	74.2	.41	.64	2.0	923	923	911	923	150	82
Pilot x Premier	2222		60.9	15.3	14.4	73.5	.34	.64	2.0	871	905	879	885	150	87
Regent x Mida	2026		61.0	15.1	14.5	75.5	.42	.64	2.0	792	894	679	855	150	85
1552 x Mida	2023		61.5	14.8	13.9	74.2	.50	.62	2.0	798	891	876	855	147	78
Mida	12008		62.8	14.6	13.7	72.5	.42	.35	2.0	809	786	761	785	809	92
1533 x Pilot	2029		62.1	13.7	12.6	70.7	.43	.62	2.0	769	792	750	770	792	85
Average Range			61.4	14.9	14.0	73.6	.42	.63	1.9	873	864	853	880	150	88
			2.6	1.9	2.1	4.8	.16	3	.5	176	178	141	153	7	7

Dickinson, N. Dak.  
(Increase Plots)

Regent x Mida	1843	12430	17.7	61.5	16.5	15.7	73.5	.47	64	2.0	980	1027	992	1000	1027	151	87	82
Thatenier	10003	15.8	60.5	14.5	13.8	73.6	.46	65	2.0	909	977	951	946	977	150	87	82	
1552 x Mida	1924	12482	24.0	62.0	14.1	13.1	73.5	.46	63	2.0	922	925	874	907	925	149	85	87
Average Range			18.4	61.3	15.2	14.3	73.2	.46	.64	2.0	961	975	955	981	150	85	86	
			8.2	1.5	2.4	2.6	1.4	.04	.2	...	58	102	93	102	2	6	6	

Table 5.—Yield, milling, baking, and chemical results on 26 wheats grown in the Uniform Regional Nursery for Eastern Composite, Western Composite, and averages of Eastern and Western Composites in 1945.

Eastern Composite

- 19 -

Variety or Cross	State or N. No.	C. I. No.	Acre Yield Bu.	Protein			Flour Pct.	Absorp- tion Pct.	Baking Methods and Loaf Volume			Wt. of Loaf Grs.	Crumb Color Score	Grain Texture Score	Aver. 90				
				Lbs.	Test Weight Bu.	Wheat Flour Yield			Milligrams of Bromate										
									0	1	2	3	4						
2822 x 2829			3172	12439	31.2	60.3	14.4	13.8	.59	.68	2.5	815	879	853	849	92			
Rescue			4188	12435	23.0	56.3	13.5	12.7	.72.1	.54	2.0	798	876	870	848	87			
Mida x Cadet			1831	12363	35.7	60.1	12.6	11.6	77.1	.51	64	2.0	824	874	844	87			
Merc. x Thatcher II-36-6712357			36.1	59.0	13.1	12.0	76.3	.57	.67	2.5	812	874	833	83	88				
2809 - 2822 x Prem.			3150	12438	35.3	61.2	13.3	12.4	76.5	.54	65	2.0	775	862	865	804			
2809 - 2822			3129	12437	34.4	59.1	13.8	12.8	76.7	.49	64	2.0	792	851	865	836			
2744 x 23C9			3175	12440	38.6	61.2	13.5	12.6	75.8	.56	68	2.5	812	865	824	834			
C. x H.T.F.			1556	12263	36.1	59.8	13.1	11.9	74.8	.48	66	2.0	818	862	856	815			
Regent x Mida			1843	12430	34.2	60.5	13.5	12.8	76.3	.52	64	2.0	839	859	809	836			
Merc. x H-44-Thatch. II-381412433			29.4	60.7	12.8	11.7	76.9	.53	.63	2.5	812	856	812	827	87				
2822 x Premier			3120	12436	33.7	59.7	12.6	12.1	77.7	.52	63	2.0	821	847	803	824			
Regent x Pilot			1753	12317	27.3	59.1	13.0	11.9	70.9	.50	66	2.5	833	842	793	824			
H-44-Marq.xThatch. II-36-1312309			31.7	59.6	12.7	11.7	74.5	.50	.65	2.0	793	842	781	734	842				
Marquis			3641	23.7	58.0	13.4	12.6	73.7	.52	63	2.5	835	830	836	834	83			
H-44-Marquis <sup>2</sup>			RL1527	12302	31.1	58.6	12.9	11.9	72.5	.50	66	2.0	798	836	793	811	836		
H-44-Marq.xThatch. II-36-49			12434	32.9	59.7	13.1	12.2	75.7	.51	66	2.0	784	833	833	817	833			
Theatcher			10003	26.1	58.3	12.3	11.5	73.7	.53	62	2.0	786	827	824	811	827			
Mida x Cadet			1752	12321	34.5	60.3	12.4	11.6	76.2	.56	65	2.0	803	806	824	811	824		
Merc. x H-44-Thatch. II-381412432			32.8	60.4	13.3	12.1	75.6	.55	.65	2.0	769	806	744	731	806	852			
Pilot x 1315			1829	12353	34.4	58.5	12.9	11.7	75.0	.45	65	2.0	803	804	800	802	804		
Rel-Hope x Pilot			1907	12366	33.7	61.7	13.6	12.4	72.5	.43	66	2.0	761	801	775	779	801		
Merit x Pilot			1860	12355	36.8	59.4	12.7	11.9	71.9	.55	63	2.5	795	798	793	797	806		
Merit x Pilot			1764	12315	34.5	59.4	12.5	11.6	72.1	.54	69	2.5	770	795	775	783	825		
Pilot x Mida			1756	12303	36.4	62.3	12.6	11.5	75.6	.46	63	2.0	749	778	758	762	832		
Pilot x Mida			1869	12324	34.6	61.7	12.6	11.5	74.3	.45	64	2.0	753	772	741	757	822		
Fillet x Mida			1750	12316	35.4	62.6	12.9	11.9	75.8	.50	65	2.0	772	772	727	757	806		
Average			32.8	59.9	13.0	12.1	74.9	.52	.63	2.2	805	830	813	834	152	87			
Range			15.6	6.3	2.1	2.3	5.6	.13	.7	0.5	113	121	92	107	7	10			

1/ From the Madison, St. Paul, Waseca, Morris, Crookston, Langdon, Fargo, and Brookings stations.

Table 5.—Continued

Western Composite  
1/

Variety or Cross	State or N. No.	C. I. No.	Acre Yield Bu.	Test Weight Lbs.	Wheat Flour Pct.	Protein Pct.	Flour Absorp- tion Pet.	Ash Pct.	Baking Methods and Loaf Volume			Average				
									Mix- ing time Min.	Milligrams of Bromate Cc. Cc.	Aver. 3 best Cc. Cc.	Opti- mum Crumb Loaf Color Grams Cc.	Texture Score			
Regent x Pilot	1753	12317	20.8	57.1	15.5	14.8	69.6	.54	65	2.5	937	394	923	937	142	35
Ceres x H.T.F.	1556	12263	23.3	57.1	16.0	15.1	69.3	.42	65	2.0	889	934	906	913	151	35
Mida x Cadet	1752	12321	24.7	56.6	15.5	14.9	73.6	.53	66	2.0	856	928	919	911	151	35
Mida x Cadet	1831	12363	25.0	58.7	15.5	14.4	72.4	.42	65	2.0	898	928	852	903	151	35
Thatcher	10003	22.5	55.8	16.4	15.6	15.6	67.9	.47	64	2.0	910	925	365	900	149	34
H-44 x Marquis <sup>2</sup>	1527	12302	20.5	55.1	16.3	15.4	66.0	.50	63	2.5	847	919	362	876	149	35
H-44-M. x Thatcher II-36-1312309	22.0	56.6	15.0	56.6	15.8	15.0	70.3	.50	65	2.0	916	913	903	912	150	35
Merit x Pilot	1764	12315	22.3	57.0	16.2	15.4	63.3	.61	70	2.5	879	917	379	892	156	37
Rescue	4103	12435	20.5	57.1	15.3	15.3	69.1	.47	62	2.5	883	917	353	884	147	32
Regent x Mida	1843	12430	22.6	58.7	16.2	15.4	72.6	.50	64	2.0	901	911	365	892	149	32
Merit x Pilot	1360	12355	24.1	57.0	15.6	15.1	71.4	.63	70	2.0	795	911	903	870	160	30
Pilot x Mida	1769	12324	23.7	58.9	15.7	14.6	69.9	.40	64	2.0	763	910	382	852	152	30
Merit x Thatcher II-36-67	12357	23.9	57.3	15.2	14.5	72.0	.51	67	2.0	871	903	365	930	152	35	
Merc. x H-44-Thatcher III-36-49	21.1	57.3	15.5	14.6	69.1	48	65	2.0	686	900	339	869	900	150	35	
28C9-2022 x Preem.	3150	12438	24.9	58.6	15.7	15.3	72.3	.49	67	2.0	815	891	356	864	153	37
2822 x Premier	3120	12436	24.1	57.8	15.1	14.3	73.5	.48	64	2.0	877	886	356	873	151	32
2744 x 2809	3175-12440	24.1	58.5	15.4	14.5	72.5	.54	69	2.5	787	852	374	848	151	37	
Marquis x Pilot	3641	19.4	57.0	16.1	15.0	68.3	.47	62	2.5	876	882	324	961	882	147	
1131 x Pilot	1907	12366	20.8	59.0	15.9	14.8	68.5	.42	65	2.0	879	881	766	842	151	32
Pilot x 1315	1029	12353	20.6	55.6	16.0	15.4	69.7	.40	64	2.0	843	879	315	847	879	151
Pilot x Mida	1756	12303	23.6	59.6	15.7	14.6	69.3	.41	63	2.0	795	879	851	842	148	32
Merc. xH-44-Thatch. II-38-44	12433	23.0	59.1	15.0	13.8	70.6	.53	63	2.0	853	873	345	857	873	151	
2809 x 2822	3129	12437	24.1	56.3	15.5	14.6	72.0	.43	64	2.0	807	859	345	837	151	37
2822 x 2809	3172	12439	22.6	53.3	15.7	14.9	72.5	.53	63	2.0	809	833	842	824	155	30
Merc. x H-44-Thatch. II-38-19	12432	23.1	56.3	15.5	14.7	71.7	.58	64	2.0	798	836	824	819	836	151	
Pilot x Mida	1750	12316	21.4	59.7	15.5	14.3	70.0	.43	63	2.0	706	830	792	803	150	33

Average Range      22.7 57.7 15.7 14.9 70.5 .49 65 2.1 3 0.5 142 145      869 895 151 107 13 13 10      33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33

1/ From the Dickinson, Havre, Moccasin, Alliance, and Akron Stations.

Table 5.--Continued

Average of Eastern and Western Composite

Variety or Class	State or N. No.	C. I. No.	Acre Yield Bu.	Test Lbs.	Wheat Pct.	Flour Pct.	Protein Pct.	Flour Yield Ash Pct.	Baking Methods and Loaf Volume			Average			
									Ab- sorp- tion Pct.	No. 6 Age Cc.	Aver- age Cc.	Opti- mum Loaf Color Cc.	Wt. of Loaf Grams	Crumb Color Score	Grain Texture Score
Mida x Cadet	1831	12363	30.4	59.4	14.1	13.0	74.8	.47	65	861	374	901	152	83	88
C. x H. T. F.	1556	12263	29.7	58.5	14.6	13.5	72.1	.45	66	359	379	393	152	83	88
Rescue	SC4188	12435	21.8	56.7	14.7	14.0	70.6	.51	63	830	835	897	149	77	88
Regent x Pilot	1753	12317	24.1	56.1	14.3	13.4	70.3	.52	66	885	874	890	149	84	89
Mercury x Thatcher	II-36-67	12357	30.0	58.2	14.2	13.3	74.2	.54	67	857	856	887	152	88	88
Regent x Mida	1843	12430	28.4	59.6	14.9	14.1	74.5	.51	64	870	864	885	150	84	90
H-44-Marquis x Thatcher	II-36-13	12309	26.9	58.1	14.3	13.4	72.4	.50	65	857	810	880	151	85	92
2809 - 2822 x Premier	3150	12438	30.1	59.9	14.5	13.9	74.4	.52	66	795	854	878	153	87	90
H-44 x Marquis	FLL527	12302	25.8	56.9	14.6	13.7	69.3	.50	65	823	844	878	153	80	89
Mida x Cadet	1752	12321	29.6	59.5	14.0	13.3	74.9	.55	66	845	861	876	152	86	93
Thatcher	10003	24.5	57.1	14.4	13.6	70.8	.53	63	848	856	876	149	79	86	86
2744 x 2809	3175	12440	31.4	59.9	14.5	13.6	74.2	.55	69	847	841	874	152	89	92
2822 x Premier	3120	12436	28.9	58.8	13.9	13.2	75.6	.50	64	849	849	867	151	86	90
Merc. x H-44- Thatcher	II-36-49	12434	27.0	58.5	14.3	13.4	72.4	.50	66	826	843	867	151	84	88
2809 x 2822	3129	12433	26.2	59.9	13.8	12.8	73.8	.53	63	833	842	865	151	90	90
2822 x 2829	3172	12439	29.3	57.7	14.7	13.7	74.4	.46	64	800	837	862	153	89	89
Marquis	3641	21.6	57.5	15.1	14.4	14.4	74.1	.56	68	812	841	861	153	91	91
Merit x Pilot	1764	12315	28.7	58.2	14.4	13.8	71.0	.50	63	856	848	859	149	83	88
Merit x Pilot	1860	12355	30.5	58.2	13.8	13.5	71.7	.59	70	829	838	856	156	88	90
Pilot x 1315	1829	12353	27.5	57.1	14.5	13.6	72.4	.43	65	826	825	842	152	78	90
Rel.-Hope x Pilot	1907	12366	27.3	60.4	14.7	13.6	70.5	.43	66	840	811	841	152	85	89
Pilot x Mida	1869	12324	29.2	60.3	14.2	13.1	72.4	.43	64	834	805	841	152	87	90
Pilot x Mida	1756	12303	30.0	61.0	14.2	13.1	72.5	.44	63	829	802	829	150	90	92
Merc. x H-44-Thatcher	II-38-19	12432	28.0	59.6	14.4	13.4	73.7	.57	65	803	796	821	152	82	89
Pilot x Mida	1750	12316	28.4	61.2	14.2	13.1	72.9	.47	64	801	780	801	153	88	90
Average Range			27.8 9.8	58.8 4.5	14.4 1.3	13.5 1.6	72.7 6.7	.51 .16	65	837 90	840 99	865 100	152 9	85 14	90 7

Table 6.—Yield, milling, baking and chemical results on hard red spring wheats grown in North Dakota and Montana Inter-State Nurseries  
 composited from stations indicated, 1945 crop.  
 N. Dak. Interstate Nursery 1/

Variety or Class	State or N. No.	C. I. No.	Acre Yield Bu.	Test Weight Lbs.	Protein Pct.	Flour Pct.	Absorption Pct.	Mixing time	Baking Methods and Loaf Volume				Wt. of Crumb Loaf Cc.	Wt. of Grain Loaf Cc.	Grain Texture Score	Average Score				
									Milling Grams of Bromate											
									Min. Cc.	CC.	Cc.	Co.								
2744 x 2809	3196		61.0	15.6	14.5	73.2	.43	68	2.0	894	998	942	945	99.8	152	90				
Regent x 1582	1912		60.8	15.7	14.3	73.7	.42	66	2.5	908	974	950	944	97.4	150	87				
Pilot x Merit	1898		60.7	14.8	13.9	73.6	.45	68	3.0	848	968	882	899	96.8	153	90				
Newthatch Check		26.4	58.3	15.5	14.9	72.8	.40	64	2.5	903	966	916	928	96.6	148	75				
1616 x Pilot	1918	33.4	60.2	14.6	13.8	73.8	.42	65	2.5	877	957	911	915	95.7	149	92				
1556 x 1563	1840	36.9	59.1	14.6	13.6	72.2	.40	65	2.5	879	956	908	914	95.6	148	90				
Pilot x Merit	1984	33.6	60.0	14.4	13.4	72.6	.37	64	2.5	910	950	901	920	95.0	148	85				
Merit x Pilot	1792	37.5	60.8	14.7	13.8	72.7	.46	67	2.5	824	939	911	891	93.9	152	85				
2822 x Regent	3123	29.1	59.4	15.2	14.4	74.3	.37	65	2.5	881	931	905	906	93.1	149	87				
2744 x 2809	3200	37.6	61.1	15.5	14.5	73.7	.42	69	2.5	905	925	871	900	92.5	152	90				
Comet x 1121	1609	33.0	61.1	14.1	12.9	73.6	.39	64	2.0	832	923	842	869	92.3	148	88				
Mida x Cadet	1835	34.7	61.4	14.2	13.5	74.2	.40	65	2.0	824	922	856	867	92.2	152	90				
2822-2809 x Premier	3169	35.9	60.5	15.5	14.8	74.2	.42	65	2.0	809	917	911	879	91.7	152	88				
Pilot x Mida	1964	35.9	60.6	13.7	12.7	74.2	.36	63	2.5	877	911	865	884	91.1	149	87				
Pilot x Mida	1953	38.5	63.3	14.1	13.1	73.6	.36	64	2.5	815	905	856	859	90.5	150	92				
1552 x Mida	1924	37.3	62.1	14.0	12.9	75.2	.43	64	2.0	830	894	865	863	89.4	149	88				
Pilot x Mida	1775	32.9	62.0	14.9	14.1	73.6	.39	65	2.5	888	891	865	881	89.1	150	88				
C. K. H. x Mercury	1882	38.3	61.0	14.4	13.5	74.8	.42	65	2.5	827	889	876	864	88.9	149	88				
2822-2809 x Premier	3167	38.1	61.2	14.9	14.4	75.5	.40	67	2.0	786	889	862	846	88.9	154	88				
2744 x 2809	3120	12439	36.4	60.8	15.2	14.1	73.3	.41	65	2.0	827	888	848	854	88.8	148	92			
2744 x 2809	3174	41.2	61.6	14.7	14.0	74.2	.43	66	2.0	824	886	865	858	88.6	154	92				
2822 x Premier	3142	30.5	60.4	14.8	13.9	76.7	.40	64	2.0	809	879	874	854	87.9	152	88				
Mercury x K.H.	2010	41.1	62.2	14.6	13.4	74.6	.42	65	2.0	833	878	847	853	87.8	152	90				
Mida x 1529	1965	35.5	61.2	13.6	12.9	74.7	.38	64	2.0	827	874	868	856	87.4	149	85				
2822 x 7.29.14.6	3185	33.6	61.1	15.1	14.0	75.8	.43	67	2.0	792	873	853	839	87.3	154	83				
C.D.C. x Mercury	2852	42.6	62.3	14.3	13.3	75.7	.39	63	2.0	824	859	812	832	85.9	149	92				
Average Range		35.5	61.0	14.7	13.8	74.1	.41	65	2.3	849	917	879	882	91.7	150	88				
		16.2	4.2	2.0	2.0	4.5	1.0	6	1.0	139	138	139	113	139	6	17				

Table 6.—Continued

## Mont. Intra State Nurseries 1/

Variety or Class	State or N. No.	C. I. No.	Acre Yield Bu.	Test Weight lbs.	Protein Pct.	Flour Pct.	Wheat Flour Yield Pct.	Absorption Pct.	Mixing time Min. Cc.	Baking Methods and Loaf Volume				Average Score
										Milligrams of Bromate Cc.	Min. Cc.	Aver. 3 best Cc.	Optimum Loaf Cc.	Wt. of Crumb Color Cc.
Thatcher x Pilot	1984	12443	14.0	54.5	17.4	16.9	69.5	44	66	2.0	953	969	1036	1036 151
Pilot x Mida	1979	15.1	57.1	54.5	17.2	16.3	67.6	42	65	2.5	986	998	948	937 148
Pilot x 1441-Renown	1991	14.3	54.8	16.8	15.9	66.8	43	65	2.0	956	932	963	970 151	
Pilot x Merit	1969	12490	15.0	56.2	16.8	15.7	70.3	47	67	3.0	919	986	959	955 150
1567 x Pilot	1975	11945	14.0	54.8	17.0	15.8	66.7	44	65	2.5	925	933	974	961 151
Pilot	2083	12491	14.6	58.8	16.6	15.5	69.9	41	65	2.5	942	975	865	934 150
1449 x Pilot	1893	12442	15.2	55.4	17.1	14.3	69.5	44	65	2.5	965	969	957	964 148
Pilot x Merit	1774	14.3	56.0	17.0	15.9	69.9	43	63	3.0	943	968	896	936 149	
1567 x Merit	1955	14.0	53.6	16.6	15.5	62.2	41	66	2.5	956	937	922	936 149	
Pilot x Merit	1968	14.7	57.1	16.2	15.1	70.4	43	66	2.5	939	948	922	936 149	
Pilot x Mida	1773	15.1	57.0	16.2	15.2	70.7	39	63	2.5	889	940	900	909 151	
Thatcher x Ceres	1947	14.2	57.3	17.5	16.3	63.4	42	63	2.0	871	937	913	907 153	
Merit x Pilot	1792	12362	16.4	57.2	16.2	15.5	70.6	51	68	2.5	876	922	936	938 153
Mida x 1529	1949	13.4	55.0	16.0	15.0	68.6	49	68	3.0	894	931	905	910 153	
Pilot x Merit	1993	15.0	56.2	16.2	15.2	68.7	47	68	3.0	870	930	919	906 152	
1449 x Pilot	2087	15.4	57.1	16.2	15.4	69.5	50	69	2.5	871	928	897	899 153	
1567 x Pilot	1355	14.0	58.6	16.2	15.0	68.3	39	67	3.0	913	925	877	905 150	
Pilot x 1315	1941	16.3	56.5	15.9	15.1	67.5	37	67	2.5	876	919	863	883 153	
Pilot x Mida	1953	12445	15.5	59.5	16.0	14.9	70.9	40	66	2.5	862	908	903	909 152
Mida x 1577	2090	14.2	55.7	15.7	14.7	66.8	41	66	2.5	866	881	845	864 152	
Pilot x Mida	1953	12445	15.5	59.5	16.0	14.9	70.9	40	66	2.5	862	908	903	909 152
Mida x 1577	2090	14.2	55.7	15.7	14.7	66.8	41	66	2.5	866	881	845	864 152	
Morit x 1315	1948	14.3	53.3	15.6	14.9	69.2	45	67	3.0	848	874	859	860 154	
Merit x K.H.C.	1992	14.3	56.2	16.1	15.1	69.0	49	70	3.0	736	851	818	802 155	
Regent x 1315	1950	17.8	55.3	14.9	14.1	70.4	42	65	2.5	847	845	836	843 153	
Pilot x 1315	2031	14.3	57.1	15.2	14.2	68.9	43	68	2.5	836	841	813	830 153	
Average Range		14.7	56.2	16.4	15.4	69.2	44	67	2.6	915	925	915	938 151	
		4.7	6.2	2.6	2.7	4.2	1.4	7	1.0	150	180	200	195 7	
													37 37	

1/ Moccasin and Havre 2

Table 7.—Yield, milling, baking, and chemical results on hard red spring wheats grown in the station nurseries at Langdon and Dickinson in 1935.

Langdon, N. Dak.

Variety or Class	State or N. No.	C. I. No.	Acre Yield	Test Weight	Wheat Flour	Protein Pct.	Flour Pct.	Ab-sorption Pct.	Mix-ing time	Baking Methods and Loaf Volume				Wt. of Crumb Color	Grain Texture Score	Average Score			
										Milling of Bromate									
										0 Cc.	1 Cc.	2 Cc.	3 Cc.						
Baart	1121 x 1501	1919	30.1	61.4	14.2	13.6	76.1	50	67.0	2.0	327	379	931	159	90	37			
Pilot x Mida	1725	31.1	60.2	13.9	13.3	77.0	46	64.0	2.5	333	386	851	152	95	95				
Mida	Check	31.3	62.5	14.1	13.6	77.3	45	67.0	2.5	309	376	362	159	97	92				
Regent x Pilot	1920	31.3	53.8	13.5	12.9	74.3	47	62.0	3.0	362	373	362	150	83	85				
Rel. H x H44 Ceres	1706	36.7	60.5	14.4	13.6	76.4	54	66.0	2.5	778	370	856	152	87	90				
Regent x 1139.22	2044	29.1	60.5	13.9	13.3	76.9	47	60.0	3.0	787	362	824	150	78	53				
Mida x 1529	2013	31.9	62.0	13.7	13.2	76.2	44	66.0	2.5	779	303	330	818	817	82	90			
1814 x Cadet	2015	23.9	60.7	12.5	11.7	74.3	43	64.0	2.5	766	318	307	97	918	156	92			
Regent x 1139.22	1911	25.2	60.8	13.4	12.3	74.7	47	62.0	2.5	795	315	795	302	315	152	90			
Pilot x Merit	1774	28.5	50.5	13.6	13.0	74.5	49	64.0	2.5	723	815	783	774	815	150	87			
1441 x Merit	1703	34.5	60.7	13.4	12.6	76.7	43	64.0	2.5	778	307	761	782	307	156	97			
Mida x 1576	1910	26.3	62.2	13.3	12.5	75.6	43	65.0	2.0	750	755	795	749	767	157	90			
1563 x Merit	2011	35.3	61.6	13.4	12.7	77.5	47	62.0	3.0	723	772	789	753	773	150	83			
1563 x Merit	1916	28.9	61.7	13.3	12.6	76.3	44	66.0	2.5	715	749	736	749	761	159	92			
1441 x 1444	1840	27.1	59.6	14.4	13.6	74.7	42	62.0	4.0	726	733	717	742	723	150	83			
1505 x Cadet	1909	23.9	62.2	12.3	11.6	75.1	42	66.0	2.5	755	764	747	755	764	155	87			
Average Range		29.7	60.0	13.6	12.9	75.9	46	64.2	2.6	789	817	817	807	831	154	83			
<u>Dickinson, N. Dak.</u>																			
1552 x Mida	2032	24.3	61.4	14.6	13.8	73.8	42	67	1.5	318	376	362	859	832	155	77			
1552 x Mida	2084	26.8	62.5	14.1	13.1	73.2	36	64	2.0	755	842	800	799	842	151	73			
Pilot x Premier	2035	26.3	61.9	14.7	13.7	73.9	36	64	2.0	827	839	798	821	839	150	85			
1552 x Mida	2033	26.6	62.5	14.2	13.0	71.6	37	61	2.0	761	815	204	793	815	151	75			
Mida	12003	26.5	63.0	14.7	13.3	74.5	35	64	2.0	792	815	718	775	815	148	90			
H-44-1018 x 2791	1990	32.8	59.4	13.9	12.8	73.7	37	64	2.0	752	780	671	734	780	152	83			
H-R.R. x K-H-R-H	1752	26.5	60.2	14.1	12.9	73.3	42	64	2.0	741	766	743	750	766	150	83			
Merc. x K-Hus.	1736	32.1	62.3	14.4	13.3	72.5	40	67	2.0	745	761	726	744	761	155	85			
Merc. x K.-Hus.	1999	31.6	62.0	14.5	13.4	72.3	39	66	2.0	732	752	741	742	752	154	83			
Average Range		23.2	61.7	14.4	13.3	73.2	38	65	1.9	792	792	806	806	806	152	82			
		2.5	3.6	1.8	1.0	2.9	.07	3	.5	90	133	127	130	130	15	5			

#### SPRING-WINTER WHEAT COMPARISON

Samples of four hard red spring wheats and 4 hard red winter wheats were again obtained from Sheridan, Wyoming, where they were grown on similarly prepared fallow to determine if comparable high protein spring wheats would respond to increasing amounts of bromate as has been found characteristic of the winter wheats. This is the 5th season such samples have been collected and tested. The response to varying amounts of potassium bromate (0 to 4 mgs per 100 g. of flour) for the 1945 samples and a summary of the data for 5 years is shown in table 3. Samples of each of the 8 varieties were milled on the Buhler mill.

The baking results show that the bromate requirements for the 1945 winter wheats averaged twice as high as those of the spring wheats. It should be pointed out that the flour protein was nearly a percent higher in the winter wheats as compared with the spring wheats. In the 1945 winter samples three of the four varieties needed 2 mgs. of bromate with the other sample requiring 4 mgs. of bromate for optimum results. Three of the spring wheat samples, by comparison needed only 1 mg. of bromate with the other sample taking 2 mgs. of bromate. In 1944 the winter wheats required nearly twice the amount of bromate as the spring wheats, with a spread in flour protein of .6 of a percent being highest in the spring wheats. The baking results for the 1943 samples showed that the spring and winter wheats responded much alike requiring 2 and 3 mgs. of bromate while in 1942 both classes of wheat needed approximately 2 mgs. of bromate. In 1941, however, the winters required a higher percentage of bromate averaging 3 mgs. for optimum results as compared with the spring wheats which required a maximum of 2 mgs. for best results. In 1944 and 1945 some of the winters needed as much as 4 mgs. for optimum results while the spring wheats averaged much less. There was less differences in the average bromate response between the two classes of wheat in 1942 and 1943 than in either of the other 5 years. In three of the years (1942-1943-1944) the average flour protein content was highest on the spring wheats averaging 2.6 percent more for the 1942 samples. In 1941 the winter and spring wheat flours averaged the same in flour protein while in 1945 the winter wheat flour averaged higher in protein than the flour from the spring wheats. A summary of the five years results shows the hard red spring wheats to average higher in protein and loaf volume but to have slightly lower bromate requirements as compared with the winter wheats. The hard red spring varieties, for the five years tested, also averaged higher in grain and texture and were much better in crumb color as compared with the same baking properties of the hard red winter varieties. The hard red winter wheats averaged about the same in test weight per bushel, slightly higher in yield of flour but were much lower in ash content of flour than the spring wheats.

Table 2.—Yield, milling, baking, and chemical results on 4 hard red spring wheats and 4 hard red winter wheats, milled on the Builer Mill and baked to show bromate response on the two classes of wheat, grown on comparable fallow land at Sheridan, Wyo., 1945, together with a 5-year summary.

Class and Variety	C. I. No.	Acre Yield Bu.	Test Weight Lbs.	Protein Pct.	Wheat Pct.	Absorp- tion Pct.	Flour Yield Pct.	Ash Pct.	Baking Methods and Loaf Volume				Average Score	
									Milligrams of Bromate					
									Min. Cc.	Cc.	Cc.	Cc.		
Hard Red Winter	6155	26.6	53.3	16.7	15.4	64.4	.43	60.0	945	992	916	931	956	
Minturki	10094	26.0	54.0	16.8	15.7	67.0	.42	63.0	905	992	912	925	943	
Nobred	6700	31.8	53.6	17.6	15.6	69.9	.46	66.0	740	962	980	983	975	
Karmen	5146	40.0	58.4	14.2	13.1	74.0	.41	60.0	758	812	772	798	812	
Average Range	31.1	14.0	54.8	16.3	15.0	68.8	.43	62.3	205	180	208	185	181	
Hard Red Spring	Ceres	6900	32.0	54.8	15.9	15.0	71.5	.49	65.0	20	865	936	916	
Thatcher	10003	31.5	53.3	16.1	15.3	71.5	.50	65.0	2.5	928	925	839	897	
Cadet	12053	23.2	53.0	15.7	15.0	70.8	.51	64.0	2.0	871	910	865	882	
Pilot	11945	37.3	57.1	12.5	11.6	71.6	.52	62.0	2.5	761	775	755	764	
Average Range	31.0	14.1	54.6	15.1	14.2	71.4	.51	64.0	2.3	878	877	862	887	
Four Hard Red Spring Wheats	Average	27.0	57.3	16.5	15.5	67.6	.53	65	1.8	161	170	142	161	
Four Hard Red Winter Wheats	Average	33.2	57.5	15.8	14.9	68.5	.47	62	1.9	899	958	958	846	
Ave.														
Year														
1941 1942 1943 1944 1945														
Summary 5 years-1941 to 1945 Br. Req.														
Four Hard Red Spring Wheats	1941	25.8	55.8	17.2	16.3	58.5	.52	66	2.0	1.5	953	1002	149	
Four Hard Red Winter Wheats	1942	23.9	56.8	18.5	17.3	71.0	.51	66	2.0	2.0	953	1090	148	
Four Hard Red Spring Wheats	1943	37.2	58.7	15.6	14.3	66.4	.59	64	2.0	2.5	828	887	150	
Four Hard Red Winter Wheats	1944	17.3	60.6	15.9	15.0	70.6	.51	63	1.7	1.7	901	923	88	
Four Hard Red Spring Wheats	1945	31.0	54.6	15.1	14.2	71.4	.51	64	2.3	1.2	862	887	153	
Four Hard Red Winter Wheats	Average	27.0	57.3	16.5	15.5	67.6	.53	65	1.8	1.8	899	958	150	
Four Hard Red Spring Wheats	1941	35.7	56.9	17.0	16.4	68.8	.42	63	2.1	3.0	873	991	149	
Four Hard Red Winter Wheats	1942	40.7	56.8	15.7	14.7	67.5	.52	63	2.1	2.2	812	870	149	
Four Hard Red Spring Wheats	1943	41.5	59.9	14.8	13.9	66.7	.52	61	2.0	2.7	737	781	148	
Four Hard Red Winter Wheats	1944	16.8	59.2	15.3	14.4	70.6	.45	62	1.3	2.7	894	909	150	
Four Hard Red Spring Wheats	1945	31.1	54.8	16.3	15.0	68.8	.43	62	2.1	2.5	917	945	153	
Four Hard Red Winter Wheats	Average	33.2	57.5	15.8	14.9	68.5	.47	62	1.9	2.6	846	899	149	

U.S.D.A., NORTH DAKOTA AND MINNESOTA METHODS

The same composite flours of seven uniform wheat varieties for the eastern and western sections were baked a sixth year by different methods including those used by the North Dakota and Minnesota laboratories. The results from the U.S.D.A. laboratory using the North Dakota and Minnesota methods and the present U.S.D.A. methods are shown in table 9.

The results from the Minnesota methods show that the 2-hour fermentation gave the best results. This is in general agreement with past years results. Cadet, appears to have greater fermentation tolerance than the other varieties as judged by the comparison of the loaf volumes for the 2 and 3 hour fermentation periods. Cadet and Regent were best in fermentation tolerance for last year's tests. The loaf volumes are again lower than either of the former or present U.S.D.A. methods and the North Dakota methods. These lower loaf volumes are due in part to the Minnesota method of sealing doughs to a uniform weight of 150 grams for all varieties, a practice not followed by the other laboratories.

The Western Composite samples baked by the Minnesota methods averaged higher than the Eastern Composite samples in loaf volume. The protein content of the Eastern Composite samples were lowest. Certain varieties, especially Regent, Pilot, and Rival from the Eastern Composite and Thatcher, Pilot, Newthatch, and Marquis from the Western Composite appears to be more severely injured than the other varieties, by the longer (3hr.) fermentation. The Western Composite varieties, as an average, showed more injury by the longer fermentation than did the Eastern Composite varieties. The varieties have been ranked in descending order of loaf volume for all the baking methods used, with the average rank and loaf volume of all 8 methods included for comparative purposes. The data show that of the two Minnesota methods, the 2-hour fermentation method ranks the varieties better as compared with the averages of all 8 methods. Regent, Newthatch, and Cadet rank highest (2-hour fermentation method) in the Eastern Composite and Thatcher, Cadet, and Pilot were best in the Western composite.

The results from the North Dakota malt-phosphate bromate method shown in table 9 are given for both the 2- and 3-hour fermentation periods. As with the Minnesota methods, the 2-hour fermentation method gave the best results. The Western Composite samples baked by the North Dakota 2-hour fermentation method averaged higher than the Eastern Composite samples in loaf volume. The Western Composite samples averaged about 2 percent higher in protein content than the Eastern Composite samples. The loaf volumes of the bread by the North Dakota methods averaged higher than the Minnesota methods. The best North Dakota method (2-hours fermentation) produced loaf volumes that were generally equal to the optimum loaf volumes by the U.S.D.A., methods. The North Dakota malt-phosphate-bromate baking method (2 and 3-hour fermentation) most always makes bread that averages poorer in grain, texture, and crumb color than the grain, texture, or crumb color of the bread by the Minnesota or U.S.D.A., methods. Thatcher, Mida, and Cadet in the Eastern Composite and Cadet and Ceres in the Western Composite appears to have greater fermentation tolerance than the other varieties as judged by a comparison of the 3-hour with the 2-hour fermentation periods. Cadet was one of the better varieties in last year's tests. The results of the 2 methods used show that the 2-hour fermentation method possibly ranked the varieties better than the 3-hour fermentation method as compared with the average ranking of all methods. Newthatch, Cadet, and Regent rank highest (2-hour fermentation method) in the Eastern composite and Newthatch, Thatcher, and Cadet in the Western Composite were best.

The results from the U.S.D.A. tests, including the No. 6 bread baking method used as one of the tests for the last seven years is shown in table 9. The individual and optimum loaf volumes are shown for all of the varieties. The optimum loaf volumes are considered as the more important data of the tests made in appraising the quality of the varieties. The optimum loaf volumes for the Eastern Composite samples averaged lower than the Western Composite samples. These results are in accordance with the results obtained by the Minnesota and North Dakota methods. In ranking the varieties the U.S.D.A. optimum loaf volumes appear to be in better agreement with the North Dakota 2-hour fermentation method and possibly the Minnesota 2-hour fermentation method than any of the other methods used. The ranking by the U.S.D.A. optimum loaf volumes is in excellent agreement with the average rank of all 8 methods. For the Eastern Composite Newthatch, Cadet, and Rival, and for the Western Composite Thatcher, Pilot, and Cadet led. Cadet was one of the best varieties last year. In the Western Composite, Thatcher and Pilot were highest in optimum loaf volume averaging above 1000 cc. and better in this respect as compared with the other varieties.

Table 9.—Uniform Varieties, 1945, composited from Eastern and Western Stations, baked by 8 methods

Variety	U. S. D. A. Methods				Minnesota Methods				North Dakota Methods				All 8 Methods			
	(No. 6) Milligrams of bromate				Fermentation				Fermentation				Methods			
	0	1	2	3	4	Optimum	Rank	2 hrs.	Rank	3 hrs.	Rank	2 hrs.	Rank	3 hrs.	Rank	Average
<b>Eastern Composite</b>																
Newthatch	801	892	908	818	908	1	789	2	713	2	916	1	806	2	830	1
Cadet	750	848	876	856	876	2	767	3	741	1	888	2	835	1	820	2
Rogent	753	853	848	778	853	4	815	1	703	3	888	3	798	3	805	3
Rival	773	851	865	806	865	3	735	5	649	7	824	4	713	7	773	4
Thatcher	768	833	839	775	839	6	741	6	680	4	792	7	775	4	775	5
Mida	795	824	812	781	824	7	729	7	657	5	824	5	772	5	774	6
Pilot	806	842	818	763	842	5	744	4	652	6	821	6	724	6	771	7
Average Range	779	849	852	797	858	760	86	685	850	774	120	793	59	793	59	
<b>Western Composite</b>																
Thatcher	919	1015	986	913	1015	1	925	1	806	2	983	2	888	2	929	1
Cadet	830	965	948	968	968	3	902	2	821	1	977	3	962	1	922	2
Pilot	942	1009	959	862	1009	2	892	3	756	4	934	5	807	6	896	3
Newthatch	818	956	939	862	956	5	865	4	759	5	989	1	876	3	883	4
Marquis	830	905	959	891	959	4	842	5	732	6	937	4	813	5	864	5
Ceres	795	908	956	851	956	6	824	6	769	3	908	6	824	4	854	6
Mida	778	903	876	764	903	7	769	7	697	7	888	7	761	7	805	7
Average Range	845	952	946	873	967	860	764	945	848	879	201	124	201	124	879	124
<b>Average of Eastern and Western Composites</b>																
Cadet	790	907	912	912	912	4	835	1	781	1	933	2	898	1	871	1
Newthatch	810	924	924	840	932	1	827	3	736	3	953	1	841	2	857	2
Thatcher	844	924	913	844	927	2	833	2	743	2	888	3	830	3	852	3
Pilot	874	926	886	813	926	3	818	4	709	5	876	4	766	5	834	4
Mida	787	864	844	773	864	5	749	5	727	4	856	5	767	4	796	5
Average Range	821	909	896	836	912	58	812	86	739	72	902	97	820	132	842	75

### COMMERCIAL SAMPLES

As in past years a number of commercially grown wheat samples were obtained through the Grain Branch, Production and Marketing Administration, for comparison with the varieties and strains produced in experimental plots. Fifteen such samples, representing a number of grades and types were obtained at Great Falls, Montana, and Minneapolis, and Duluth, Minnesota. The samples were composited by grade from 2593 cars of wheat grading No. 3 or better and represent the better grades of hard red spring wheats received at these markets. This is the seventh season such samples have been tested. The results are given in table 10.

These samples generally averaged lower in protein content than the experimental plots and nursery samples. The few exceptions, however, were the samples from a number of the stations in the eastern and western parts of the spring wheat area (St. Paul, Waseca, Morris, Crookston, Minnesota; Langdon, Edgeley, North Dakota; Newell, South Dakota; Laramie, Wyoming; and Akron, Colorado) that were approximately the same in protein as the commercial samples. Otherwise, the milling, baking, and chemical results do not appear to be greatly different, especially when compared with samples having approximately the same protein content and test weight. The correlation coefficient for loaf volume and protein content was high ( $r=0.9459$ ).

### CORRELATION AND REGRESSIONS

Correlation coefficients ( $r$ ) for loaf volume and flour protein content of 14 varieties and strains and also the commercial samples have been calculated and are presented in table 11. Also indicated in this table is the slope of the regression line or the cubic centimeter change in loaf volume for each 1.0 percent of protein ( $b_1$ ), the average protein content of the flour and the loaf volumes of the bread, and the loaf volumes adjusted to a 13.0 percent protein basis by the means of the regression equation. The plotted regression lines for each variety and the commercial samples are shown in figures 1 and 2.

The figures show that the relation between loaf volume and protein content is generally linear. These results are in accordance with last year's (1944) results, where, with a few exceptions the points fall on or very close to the calculated regression lines. The majority of the correlation coefficients for loaf volume and flour protein coefficients for loaf volume and flour protein content were high. The highest coefficients were for Ceres, Pilot x Mida, N.N. 1756, Commercial Grades, and Marquis. These were among the highest last season. The wheats having the lowest correlation coefficients this season were Rival, Pilot x Mida, N.N. 1750 and Regent x Pilot, N.N. 1753. It should be noted that the number of samples of each variety is rather small for a study of this kind. This fact should be considered in evaluating the results.

One of the important results of this study of this study and of interest are the differences in the level and particularly in the slope of the regression lines for the different varieties. The regression lines for the varieties and strains (4 and 5 varieties grouped together) have been included in separate graphs in figures 1 and 2 with the regression line for Thatcher repeated in each graph as a standard of comparison. The regression line (figure 1, graph 1) for Pilot is highest; with Ceres the lowest. The slope of the regression line for Henry (figure 1, graph 2) is substantially higher but not as steep as compared with the regression line for Thatcher. Only five samples of Henry were milled and baked and so not too much significance can be attached to this comparison. Mida is very similar to Thatcher with respect to the regression line and Marquis which has about the same slope is at a slightly lower level. The regression lines for many of the new and more promising strains are shown in figure 2, graph 3. Regent x Pilot, N.N. 1753 (only 5 samples examined) has a much different slope of the regression line being not as steep but considerably higher than the line for Thatcher. The regression lines for Pilot x Mida, N.N. 1756 and Mida x Pilot, N.N. 1764 are generally similar in slope and level as contrasted with the slope of the line for Thatcher. The slope of the line for Pilot x Mida, N.N. 1750 was lower and not as steep as the line compared with Thatcher. The slope of the line for Regent (figure 2 graph 4) compares favorably with the slope of the line for Thatcher, with Cadet averaging intermediate and Newthatch lower.

Table 10.—Milling, baking, and chemical results on fifteen composite commercial samples of hard red spring wheat obtained at Minneapolis, Minn., Duluth, Minn., and Great Falls, Mont., representing the 1945 crop.

Location where obtained	Samples composed from car lots	U. S. Grade	Test Wt.	Protein			Flour			Water absorption average	Baking Methods and Loaf Volume			Average		
				Wheat	Flour	Ash	Yield	Pct.	Pct.		Min. Cc.	Aver. 3 best	Optimum Loaf Cc.			
Great Falls, Mont.	404	1 D.M.S.	59.2	15.3	14.4	4.3	63	1.5	856	873	874	862	870	85	92	
	173	1 Hvy.D.N.S.	61.1	15.7	12.8	73.1	62	2.0	795	815	827	772	812	87	88	
	317	3 D.N.S.	56.4	16.8	15.9	70.2	43	1.5	928	974	959	954	974	87	92	
Minneapolis, Minn.	106	1 Hvy.D.N.S.	61.2	12.4	11.6	73.3	43	62	2.0	699	704	698	700	704	80	83
	238	1 D.N.S.	59.9	13.1	12.4	72.7	43	63	2.5	781	795	744	773	795	82	83
	100	2 D.N.S.	57.5	13.9	13.0	72.6	46	61	2.5	815	835	779	810	836	23	26
Do.	114	3 D.N.S.	56.9	14.2	13.4	72.4	47	62	2.5	818	827	821	823	827	23	26
	116	1 N.S.	59.5	12.2	11.2	73.9	46	61	2.5	683	695	624	684	695	83	90
	180	2 N.S.	53.1	12.9	11.7	73.9	45	61	2.5	753	747	752	746	753	85	83
Duluth, Minn.	136	1 Hvy.D.N.S.	61.2	12.6	11.8	76.0	45	64	2.0	715	792	781	763	792	87	87
	184	1 D.N.S.	59.5	13.0	12.3	73.5	44	63	2.0	738	765	738	754	725	83	85
	139	2 D.N.S.	58.0	13.7	13.1	73.1	46	63	2.0	830	845	803	826	845	87	90
Do.	143	3 D.N.S.	57.0	15.3	14.5	70.0	46	64	2.0	836	910	905	884	910	83	90
	139	1 N.S.	59.6	12.6	11.7	75.1	44	62	2.0	752	755	729	745	755	82	85
	124	2 N.S.	53.6	12.3	11.3	75.2	46	62	2.0	731	706	735	774	806	82	82
Average Range			58.9	13.6	12.8	73.1	45	62	2.1	800	804	-	795	812	84	87
			4.8	4.4	4.7	6.0	.04	30	1.0	224	286	-	254	279	7	10

The relative position of the regression lines appears to be a rather satisfactory measure of the relative protein quality of these varieties. From these lines, the varieties and strains can be compared with each other by the means of loaf volume taken at a medium protein level (13.0 percent) as calculated from the regression lines. The loaf volume for each variety is the point at which the regression line crosses the 13.0 percent protein value in graphs 1 and 2. These loaf volumes arranged in descending order are shown in the last column of table 11.

Protein strength or protein quality is by no means the only measure of the suitability of a wheat variety or strain for bread-baking purposes. It is probably, however, the most important in relation to bread baking. Other flour properties considered important are mixing time, water absorption, oxidation, and bread grain texture, and crumb color. These quality factors are given in other tables.

Table 11.—Summary of protein content-loaf volume data.

Variety	No. of Samples	$b_1$ 1/	$r$ 2/	Protein of flour (pct.)	Average loaf volume (CC)	Loaf volume at 13.0 percent protein content 3/
Pilot	19	58.8	.9325	12.91	893	899
Regent x Pilot NN1753	5	23.4	.6525	12.82	891	896
Henry	5	35.5	.9241	11.16	818	882
Regent	12	50.8	.9111	13.08	880	875
Rival	11	59.9	.7964	12.66	849	867
Cadet	18	43.5	.9079	13.70	897	866
Thatchier	23	48.8	.9095	13.72	892	857
Pilot x Mida NN1756	13	46.8	.9534	12.60	834	853
Mida	18	47.7	.8527	12.93	843	848
Merit x Pilot NN1764	17	41.1	.9397	13.36	859	842
Newthatch	18	40.9	.8600	14.39	890	833
Marquis	11	52.3	.9047	12.91	831	832
Ceres	9	54.4	.9857	13.66	862	824
Commercial Grades	15	52.4	.9459	12.77	812	823
Pilot x Mida NN1750	13	37.9	.8162	12.49	775	794

1/ Slope of regression line or change in loaf volume for each 1 percent of protein.

2/ Correlation coefficients for loaf volume and flour protein content.

3/ Calculated from regression equation.

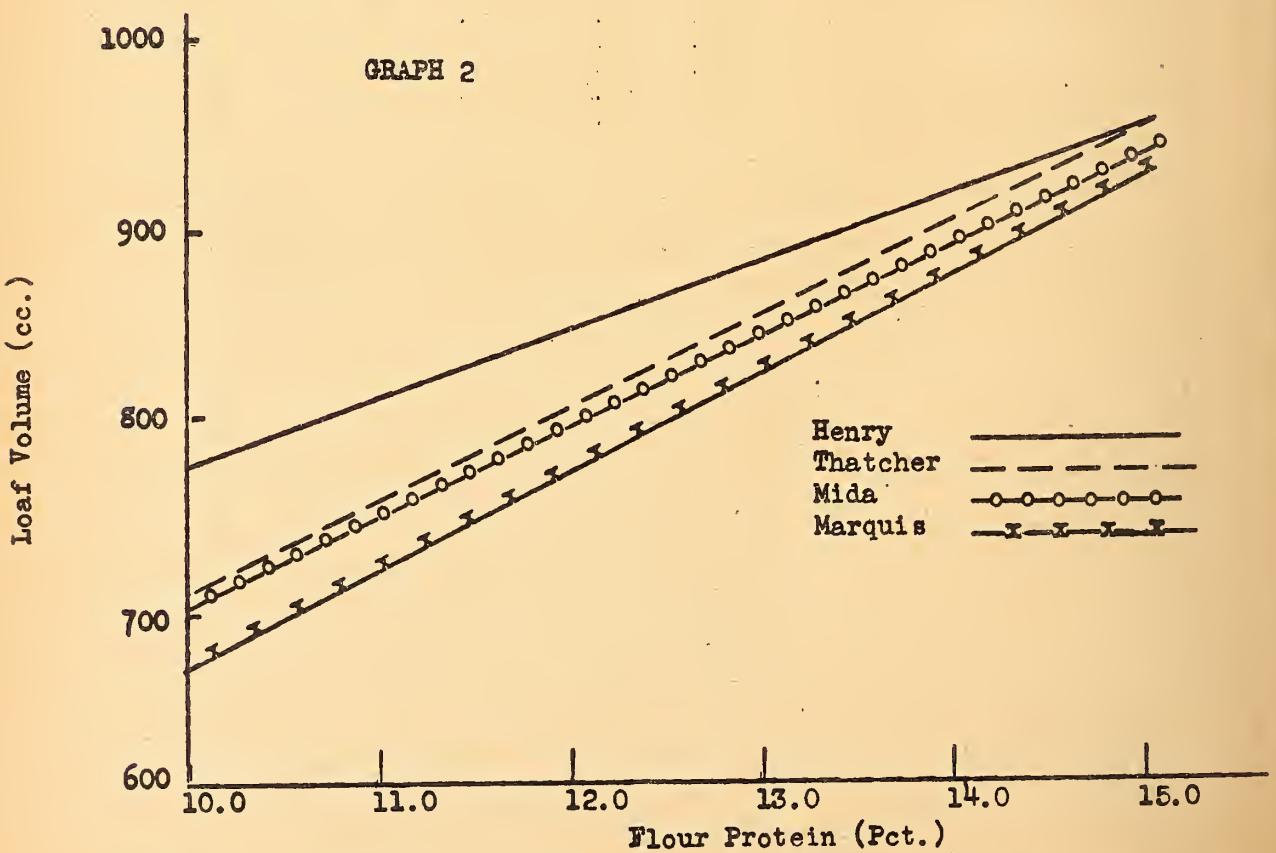
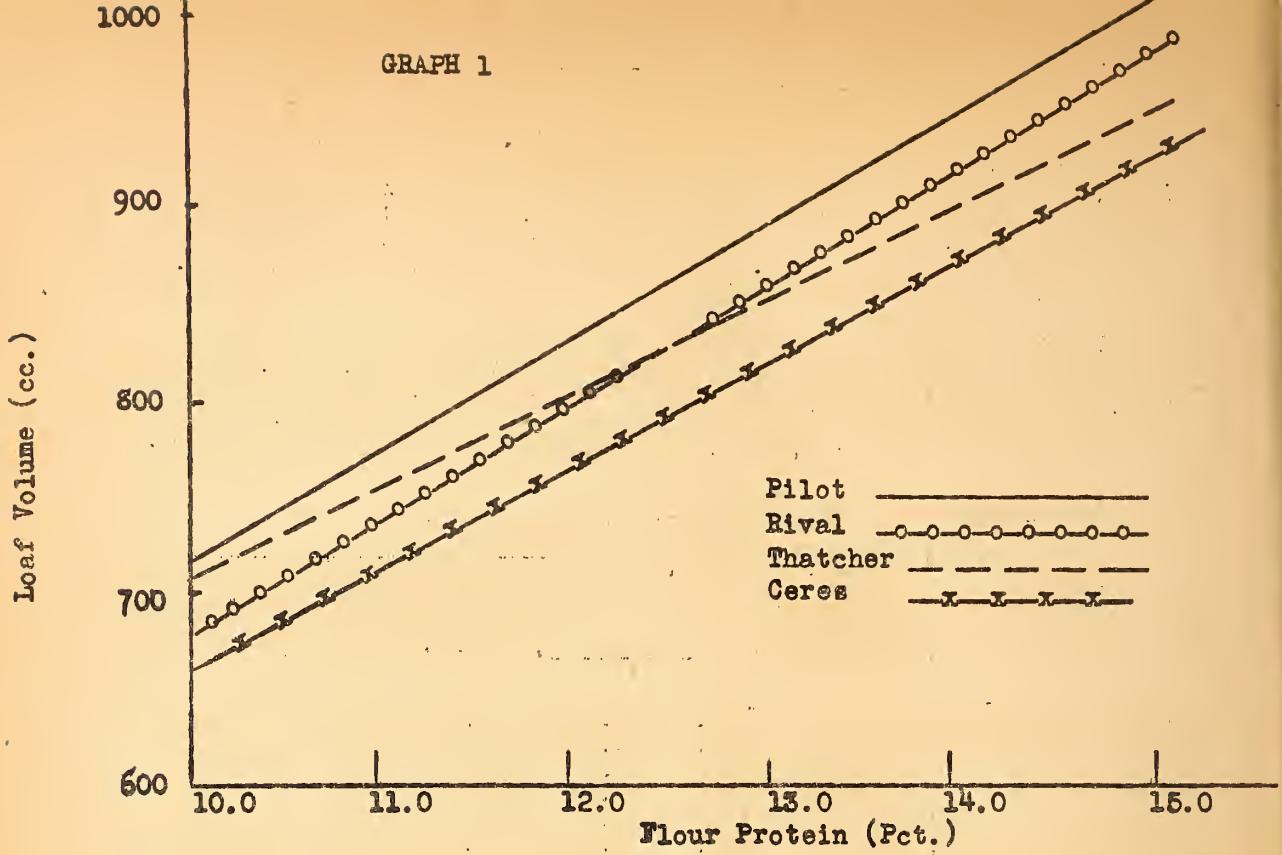


Figure 1. - Regression lines for flour protein and loaf volume for a number of hard red spring varieties and strains with Thatcher included for comparisons, 1945 crop.

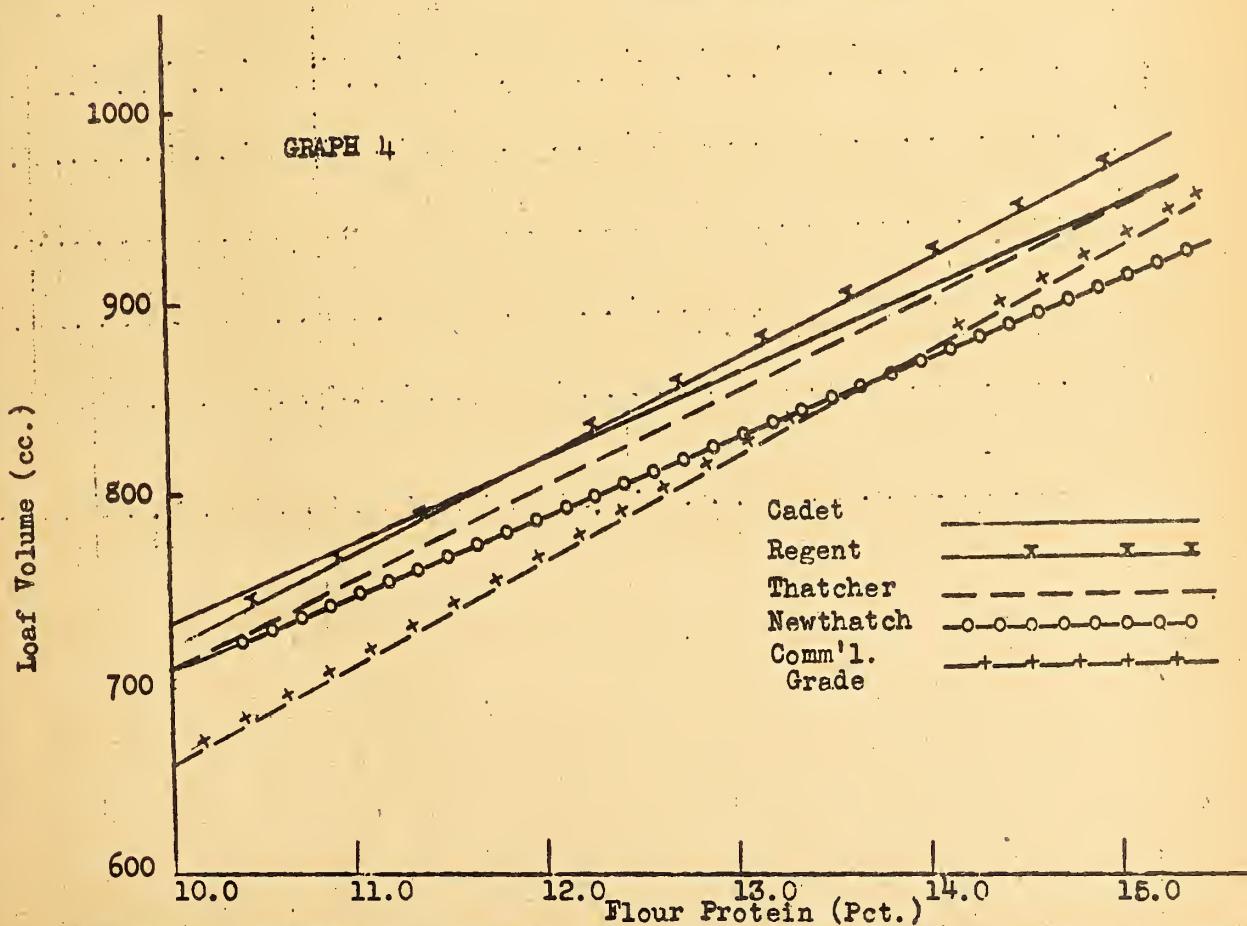
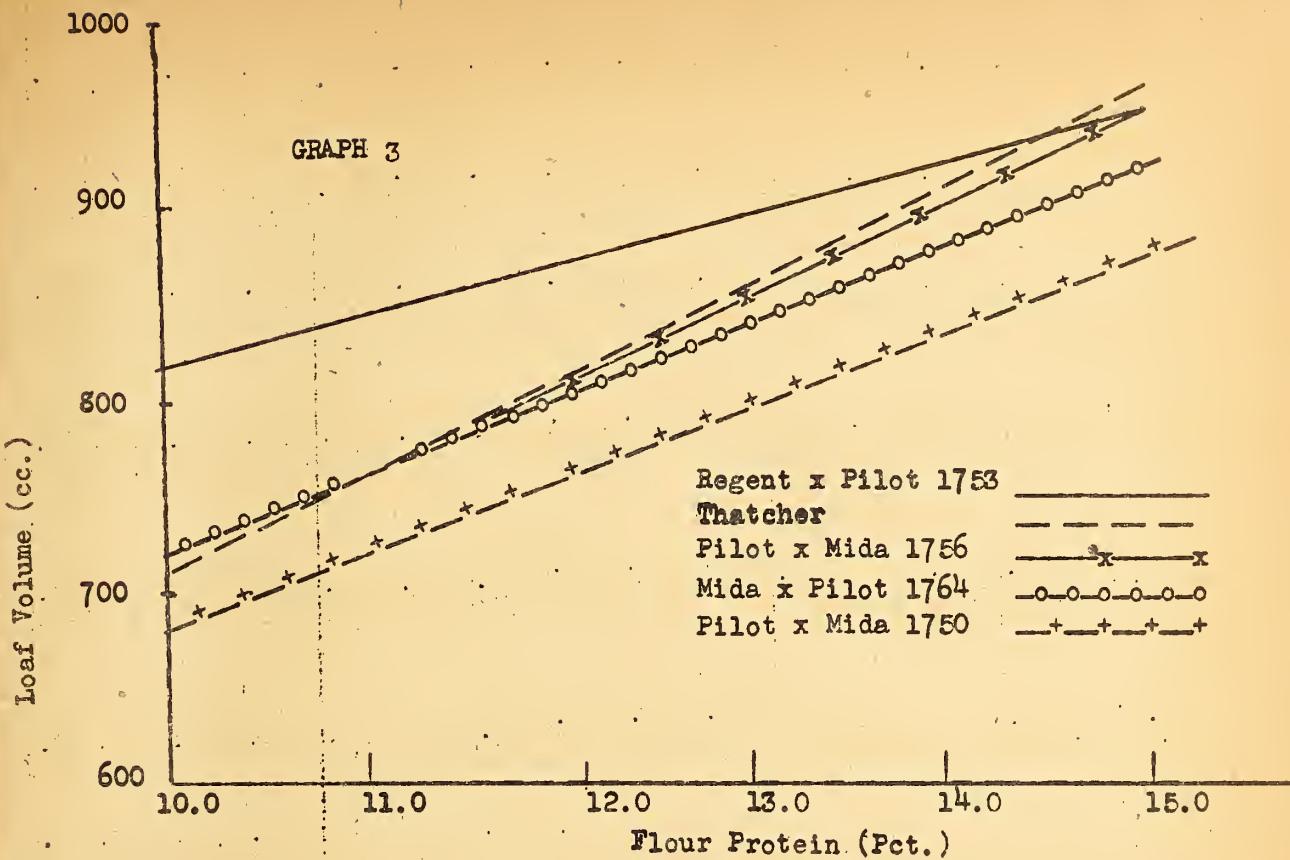


Figure 2. - Regression lines for flour protein and loaf volume for a number of hard red spring varieties and strains with Thatcher included for comparisons, 1945 crop.

Table 12.—Average of the milling, baking, and chemical properties 15 wheats, the averages of comparable samples of Thatcher, and of each variety as shown in percentage of Thatcher, with varieties arranged in order of percentage for optimum loaf volume in 1945.

Variety or Cross	No. of Samples	Yield per Acre	Test Weight	Protein			Flour Absorbency	Baking Methods and Loaf Volume			Optimum Cc.	Average Cc.	Grain Color	Crumb Color	Grain Texture Score
				Wheat Flour		Ash Content		No. 6	Average	Optimum					
				Pct.	Pct.	Pct.		Pct.	Pct.	Cc.					
N. 1556	5	25.2	60.2	14.8	13.8	72.3	.42	66	373	913	937	152	90	88	88
Thatcher	5	22.3	59.2	14.3	13.6	72.2	.47	64	885	875	896	149	83	87	87
Percentage of Thatcher	12	101.7	103.5	101.5	100.1	89.4	103.1	98.6	104.6	104.3	102.0	108.4	101.1		
Regent	12	26.0	57.5	13.8	13.0	73.0	.46	63	843	854	880	143	84	87	87
Thatcher	12	25.1	57.0	13.6	12.9	72.4	.46	62	821	851	146	84	84	84	83
Percentage of Thatcher	103.6	100.9	101.5	100.8	100.0	101.6	102.8	104.0	103.4	102.1	100.0	98.9			
S.D. 2280	3	29.1	59.4	13.6	12.9	75.4	.43	62	827	808	845	149	87	89	89
Thatcher	3	25.4	57.3	13.3	12.5	71.4	.47	63	815	811	832	146	89	88	88
Percentage of Thatcher	114.6	104.7	103.0	103.2	105.6	91.5	98.4	101.5	99.6	101.6	102.1	97.8	101.1		
N. 1753	5	28.5	58.7	13.8	12.8	71.2	.49	65	880	869	891	148	83	88	88
Thatcher	5	26.8	57.8	14.3	13.6	71.9	.48	63	855	848	878	148	81	87	87
Percentage of Thatcher	106.3	101.6	96.5	94.1	99.0	102.1103.2	102.9	102.5	101.5	100.5	102.5	102.5	101.1		
Cadet	18	25.7	56.1	14.5	13.7	71.3	.48	66	854	871	897	151	89	89	89
Thatcher	18	24.7	56.4	14.3	13.6	71.9	.47	63	853	851	885	147	83	87	87
Percentage of Thatcher	104.0	99.5	101.4	100.7	99.2	102.1	104.8	100.1	102.4	101.5	102.7	102.7	102.1		
Newnatch	18	25.1	55.9	15.0	14.4	72.8	.49	64	863	862	890	149	82	87	87
Thatcher	18	24.8	56.5	14.3	13.6	71.9	.47	63	848	846	882	147	83	87	87
Percentage of Thatcher	101.2	98.9	104.9	105.9	101.3	104.3	101.6	101.6	101.6	100.9	101.4	98.2	100.0		
Pilot	19	26.8	56.9	14.0	12.9	71.2	.45	65	869	858	892	149	87	88	88
Thatcher	19	24.3	56.4	14.4	13.7	71.7	.47	63	855	856	890	148	83	87	87
Percentage of Thatcher	110.3	100.9	97.2	94.1	99.3	95.7	100.0	101.6	100.2	100.3	100.7	100.8	101.1		
N. 1764	17	28.9	57.2	14.2	13.4	70.8	.52	67	820	829	859	153	86	87	87
Thatcher	17	25.6	56.7	14.3	13.6	71.7	.48	63	840	845	876	147	83	87	87
Percentage of Thatcher	112.9	100.9	99.3	98.5	98.7	108.3	106.3	97.6	98.4	98.0	104.1	104.2	100.0		
Rival	11	31.5	60.0	13.6	12.7	75.7	.49	65	822	826	849	150	88	90	90
Thatcher	11	25.1	56.9	13.8	13.1	72.5	.46	62	830	831	861	146	83	88	88
Percentage of Thatcher	125.5	105.4	98.6	96.9	104.4	106.5	104.8	99.0	99.4	98.6	102.7	104.9	101.6		
Henry	5	36.6	58.1	12.3	11.2	75.4	.45	62	808	801	818	149	78	86	86
Thatcher	5	26.3	55.5	13.1	12.4	72.2	.48	62	812	808	837	145	80	89	87
Percentage of Thatcher	139.2	104.7	93.9	90.3	104.4	93.8	100.0	99.5	99.2	97.7	102.1	96.8	96.6		
Mida.	18	29.9	60.0	13.8	12.9	74.6	.44	64	821	817	843	151	90	88	88
Thatcher	18	24.8	56.5	14.3	13.6	71.9	.47	63	849	848	882	147	83	87	87
Percentage of Thatcher	120.6	106.2	96.5	94.9	103.8	93.6	101.6	96.7	95.6	96.3	102.7	108.1	101.3		
N. 1756	13	28.7	59.6	13.5	12.6	72.9	.43	63	813	809	834	150	89	88	88
Thatcher	13	24.8	56.7	14.3	13.6	71.4	.48	63	851	850	882	147	62	87	87
Percentage of Thatcher	115.7	105.1	94.4	92.6	102.1	87.5	100.0	95.5	94.6	95.2	102.0	108.4	101.8		
Cores	9	23.4	58.0	14.4	13.7	70.8	.46	65	838	862	828	152	82	85	85
Thatcher	9	23.8	56.2	15.2	14.4	71.3	.49	63	879	877	921	148	84	86	86
Percentage of Thatcher	98.3	103.2	94.7	95.1	99.3	93.9	103.2	95.4	93.6	94.4	102.7	98.3	99.5		
Various	11	26.3	57.2	14.5	13.8	70.8	.48	65	866	858	880	158	83	87	87
Thatcher	11	23.8	56.0	14.2	13.6	70.8	.46	65	849	848	882	151	87	100.0	100.0
Percentage of Thatcher	89.4	101.6	95.2	93.5	98.2	93.9	100.0	94.8	94.5	93.4	101.4	100.0	100.0		
N. 1750	13	30.7	60.7	13.5	12.5	73.4	.45	64	758	749	775	151	87	85	85
Thatcher	13	26.9	57.3	13.9	13.2	72.0	.47	63	832	828	854	147	82	88	88
Percentage of Thatcher	112.6	105.9	97.1	94.7	101.9	95.7	101.6	91.2	90.5	90.7	102.7	105.7	96.9		

Table 13.—Annual and total number of samples comparable with Thatcher and weighted average milling, baking, and chemical properties expressed in percentage of Thatcher for the 8 years, 1938 to 1945.

Variety State or Nursery No.	Crop year and number of samples								Total
	1938	1939	1940	1941	1942	1943	1944	1945	
Thatcher	11	12	14	16	18	20	18	23	132
Pilot	8	11	14	13	14	14	16	19	109
Rival	8	9	9	13	11	12	10	11	83
Cadet	—	—	2	10	16	13	14	18	73
Mida	—	2	9	10	7	8	14	18	68
Regent	2	4	7	10	9	12	10	12	66
Newthatch	—	—	2	9	12	12	14	18	65
Marquis	2	4	8	9	9	8	9	11	50
Ceres	4	3	6	7	6	7	8	9	50
N. No. 1764	—	—	—	—	—	2	13	17	32
N. No. 1756	—	—	—	—	—	4	7	13	24
N. No. 1750	—	—	—	—	—	3	8	13	24
Henry	—	—	—	—	3	6	6	5	20
S. D. 2280	—	—	—	—	4	4	2	3	13
N. No. 1753	—	—	—	—	—	3	5	5	13
N. No. 1556	—	—	—	—	—	4	4	5	13

Variety State or Nursery No.	Test weight per bushel							Weighted Average
	1938	1939	1940	1941	1942	1943	1944	
N. No. 1750	—	—	—	—	—	106.6	104.9	105.9 105.7
Mida	—	104.8	105.6	107.9	106.5	104.1	102.9	106.2 105.4
N. No. 1756	—	—	—	—	—	105.5	104.1	105.1 104.9
S.D. 2280	—	—	—	—	101.4	103.6	103.1	104.7 103.1
Henry	—	—	—	—	102.4	103.0	101.4	104.7 102.8
Rival	105.1	100.7	100.2	103.6	102.6	101.0	100.3	105.4 102.4
N. No. 1753	—	—	—	—	—	102.3	101.7	101.6 101.8
Ceres	102.1	102.5	98.4	103.2	101.2	100.3	101.5	103.2 101.5
N. No. 1556	—	—	—	—	—	101.4	100.7	101.7 101.3
Pilot	100.9	100.0	100.5	102.3	101.5	100.2	100.0	100.9 100.7
Regent	101.5	97.9	98.6	102.6	102.3	100.9	99.3	100.9 100.7
N. No. 1764	—	—	—	—	—	102.0	99.8	100.9 100.5
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0 100.0
Marquis	100.0	100.7	96.1	99.5	102.3	100.9	98.9	101.6 100.0
Cadet	—	—	98.8	100.4	101.0	98.5	99.7	99.5 99.8
Newthatch	—	—	99.8	101.3	101.0	98.5	99.3	98.9 99.6

Variety State or Nursery No.	Crude protein content of the wheat								Average
	1938	1939	1940	1941	1942	1943	1944	1945	
Newthatch	—	—	102.4	108.9	107.8	106.1	104.4	104.9	105.9
Regent	106.0	103.1	102.5	106.8	106.1	104.7	104.6	101.5	104.3
Cadet	—	—	100.0	104.8	104.9	103.6	101.5	101.4	103.0
S.D. 2280	—	—	—	—	104.8	101.9	100.7	103.0	102.9
N. No. 1556	—	—	—	—	—	102.0	101.5	103.5	102.4
N. No. 1753	—	—	—	—	—	104.6	102.8	96.5	100.8
N. No. 1764	—	—	—	—	—	101.9	101.5	99.3	100.3
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mida	—	97.6	95.6	102.0	102.1	107.6	98.5	96.5	99.5
Rival	100.0	94.2	97.5	100.7	100.7	101.3	100.8	98.6	99.4
Pilot	102.0	94.2	100.0	100.7	98.6	99.3	97.0	97.2	98.4
N. No. 1750	—	—	—	—	—	100.6	98.5	97.1	98.0
Ceres	98.6	95.7	97.4	97.5	98.1	101.3	97.9	94.7	97.7
Marquis	100.0	95.1	93.2	96.9	96.0	94.4	95.7	95.2	95.4
N. No. 1756	—	—	—	—	—	97.3	94.3	94.4	94.9
Henry	—	—	—	—	97.8	95.3	92.6	93.9	94.5

Table 13.--Continued

Variety State or Nursery No.	Yield of Flour								Weighted Average
	1938	1939	1940	1941	1942	1943	1944	1945	
Henry	--	--	--	--	102.8	102.5	102.4	104.4	103.0
Rival	105.5	102.7	99.4	103.1	101.2	103.4	101.9	104.4	102.7
Mida	--	100.7	102.3	102.5	102.7	101.9	102.1	103.8	102.6
S.D. 2280	--	--	--	--	101.7	101.7	101.0	105.6	102.5
Newthatch	--	--	102.5	100.9	101.7	101.4	101.2	101.3	101.4
N. No. 1750	--	--	--	--	--	99.7	100.4	101.9	101.1
N. No. 1756	--	--	--	--	--	99.6	99.9	102.1	101.0
Regent	100.9	98.4	100.0	100.9	99.7	102.3	99.5	100.8	100.6
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cadet	--	--	99.3	99.6	100.0	100.8	99.2	99.2	99.7
Ceres	102.4	100.3	95.8	100.7	99.0	100.3	99.5	99.3	99.5
N. No. 1556	--	--	--	--	--	98.5	99.3	100.1	99.4
Pilot	98.5	99.3	98.2	99.4	99.9	99.7	98.1	99.3	99.1
N. No. 1764	--	--	--	--	--	96.9	98.2	98.7	98.4
N. No. 1753	--	--	--	--	--	97.2	97.1	99.0	97.8
Marquis	100.0	98.3	94.2	92.9	98.7	99.3	97.2	98.2	97.0

Variety State or Nursery No.	Ash in Flour								Weighted Average
	1938	1939	1940	1941	1942	1943	1944	1945	
N. No. 1764	--	--	--	--	--	109.2	104.0	108.3	106.6
Cadet	--	--	123.9	113.5	105.7	107.1	100.0	102.1	105.5
Newthatch	--	--	126.1	111.5	101.9	107.1	102.0	104.3	105.3
Rival	96.1	104.0	107.5	105.3	98.1	109.1	101.9	106.5	103.9
Marquis	100.0	101.9	107.5	109.4	103.8	110.2	100.0	93.9	103.4
Regent	104.0	111.3	115.4	103.8	92.3	100.9	98.1	100.0	101.6
N. No. 1753	--	--	--	--	--	103.6	95.9	102.1	100.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ceres	98.0	103.8	93.1	103.8	96.2	100.0	100.0	93.9	98.2
Pilot	100.0	98.0	100.0	101.9	96.2	98.1	90.0	95.7	97.1
Mida	--	85.5	100.0	105.9	92.3	94.7	96.1	93.6	96.5
N. No. 1750	--	--	--	--	--	96.3	96.1	95.7	95.9
N. No. 1556	--	--	--	--	--	101.9	96.1	89.4	95.3
S.D. 2280	--	--	--	--	101.7	93.1	90.0	91.5	94.9
Henry	--	--	--	--	87.7	93.1	90.6	93.8	91.7
N. No. 1756	--	--	--	--	--	100.0	86.0	87.5	89.2

Variety State or Nursery No.	Water Absorption of Flour								Weighted Average
	1938	1939	1940	1941	1942	1943	1944	1945	
N. No. 1764	--	--	--	--	--	109.2	106.3	106.3	106.5
Cadet	--	--	109.2	104.8	106.7	104.2	104.7	104.8	105.3
N. No. 1753	--	--	--	--	--	105.4	103.1	103.2	103.7
Rival	103.9	100.5	102.2	103.2	105.0	102.7	101.6	104.8	103.1
N. No. 1556	--	--	--	--	--	101.6	101.7	103.1	102.2
N. No. 1750	--	--	--	--	--	101.7	101.6	101.6	101.6
Ceres	102.9	97.7	101.5	103.2	101.6	100.3	100.0	103.2	101.5
Newthatch	--	--	104.6	101.1	102.1	100.6	100.0	101.6	101.2
S.D. 2280	--	--	--	--	100.0	103.3	103.1	98.4	101.1
Regent	100.7	99.1	100.5	101.6	101.6	99.4	98.4	101.6	100.5
Mida	--	97.3	99.8	98.4	101.6	100.5	100.0	101.6	100.4
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pilot	97.3	98.9	100.5	100.0	100.0	98.5	98.4	100.0	99.3
N. No. 1756	--	--	--	--	109.0	99.3	98.4	100.0	99.3
Henry	--	--	--	--	109.0	99.3	98.4	100.0	99.3
Marquis	100.0	94.8	97.1	100.0	100.0	97.4	106.9	100.0	98.4

Table 13.—Continued

Variety State or Nursery No.	Loaf Volume, Method No. 6								Average
	1938	1939	1940	1941	1942	1943	1944	1945	
N. No. 1753	--	--	--	--	--	107.7	106.8	102.9	105.4
Newthatch	--	--	97.4	103.7	103.3	99.4	103.4	101.6	102.0
Regent	109.8	100.1	99.9	105.0	103.6	95.0	105.6	102.8	102.0
S.D. 2280	--	--	--	--	104.8	98.6	94.1	101.5	100.5
Cadet	--	--	97.9	102.2	100.5	97.1	103.0	100.1	100.4
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pilot	97.3	95.8	98.0	99.6	101.1	100.6	98.9	101.6	99.5
N. No. 1764	--	--	--	--	--	96.1	101.9	97.6	99.2
Rival	95.4	94.2	90.3	97.1	101.7	99.6	106.8	99.0	98.3
Ceres	95.6	91.9	89.9	99.1	100.2	102.6	96.6	95.4	96.9
Henry	--	--	--	--	99.2	90.8	96.7	99.5	96.0
Marquis	94.2	90.9	90.0	99.3	95.3	96.0	99.1	94.8	95.5
Mida	--	87.7	88.8	91.5	98.4	98.6	98.8	96.7	95.5
N. 1556	--	--	--	--	--	85.3	99.9	98.8	94.9
N. No. 1756	--	--	--	--	--	90.4	96.0	95.5	94.8
N. No. 1750	--	--	--	--	--	86.9	91.6	91.2	90.8

Variety State or Nursery No.	Loaf Volume, Average								Average
	1938	1939	1940	1941	1942	1943	1944	1945	
N. No. 1753	--	--	--	--	--	103.7	106.6	102.5	104.3
Newthatch	--	--	97.8	102.2	102.6	99.8	101.6	101.6	101.4
Regent	101.6	98.6	99.8	102.8	101.9	94.4	106.0	104.0	101.2
Pilot	102.7	97.3	99.0	100.1	103.0	103.4	97.3	100.2	100.3
Cadet	--	--	97.7	100.2	98.4	94.9	104.1	102.5	100.1
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
S.D. 2280	--	--	--	--	104.4	96.7	96.5	99.6	99.7
N. No. 1764	--	--	--	--	--	94.8	101.3	98.4	99.4
Rival	99.0	94.0	91.0	95.9	101.0	100.0	104.1	99.4	98.2
Ceres	98.7	97.2	95.4	98.1	101.8	103.9	95.3	93.6	97.8
N. 1556	--	--	--	--	--	85.0	101.7	104.6	97.7
Marquis	96.5	93.6	91.9	98.1	95.6	98.3	98.5	94.5	96.0
Henry	--	--	--	--	96.5	89.5	97.6	99.2	95.4
Mida	--	91.5	89.2	91.9	92.6	98.8	96.4	95.6	94.9
N. No. 1756	--	--	--	--	--	92.5	94.2	94.6	94.1
N. No. 1750	--	--	--	--	--	87.7	91.3	90.5	90.4

Variety State or Nursery No.	Loaf Volume, Optimum								Average
	1938	1939	1940	1941	1942	1943	1944	1945	
N. No. 1753	--	--	--	--	--	107.0	105.9	101.5	104.5
Regent	106.6	99.7	100.5	104.9	103.1	95.3	105.9	103.4	102.0
Newthatch	--	--	97.4	103.4	103.0	99.9	101.6	100.9	101.4
S.D. 2280	--	--	--	--	104.7	98.9	97.2	101.6	101.0
Cadet	--	--	97.9	101.5	100.0	97.2	104.1	101.5	100.8
Pilot	99.3	96.0	98.5	100.0	101.4	100.6	97.8	100.3	100.3
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N. No. 1764	--	--	--	--	--	96.1	100.8	98.0	99.0
Rival	97.3	93.9	92.1	96.6	101.2	99.8	104.2	98.6	98.2
N. No. 1556	--	--	--	--	--	85.3	102.3	104.3	97.8
Ceres	97.3	91.9	90.2	99.4	100.8	102.6	95.1	94.4	96.7
Henry	--	--	--	--	98.9	90.8	97.8	97.7	95.8
Marquis	94.3	90.9	91.9	98.8	95.7	96.2	99.9	93.4	95.4
Mida	--	88.4	89.0	91.4	98.2	98.6	96.4	96.3	94.9
N. No. 1756	--	--	--	--	--	90.4	94.9	95.2	94.3
N. No. 1750	--	--	--	--	--	86.9	90.9	90.7	90.3

Table 13.--Continued

Variety State or Nursery No.	Crumb Color, Average								Weighted Average
	1938	1939	1940	1941	1942	1943	1944	1945	
N. No. 1756	--	--	--	--	--	108.6	107.2	108.4	108.1
Mida	--	108.8	103.6	111.1	107.0	108.4	105.9	108.1	107.4
N. No. 1750	--	--	--	--	--	111.3	105.9	105.7	106.5
Cadet	--	--	101.1	111.1	105.8	100.0	105.9	107.4	105.7
Pilot	109.5	101.7	100.1	103.8	105.8	106.0	103.5	104.8	104.2
N. No. 1764	--	--	--	--	--	103.9	102.3	104.2	103.7
Rival	108.9	98.2	96.4	103.6	105.8	104.8	104.7	104.9	103.5
N. No. 1556	--	--	--	--	--	97.5	102.4	108.4	103.2
N. No. 1753	--	--	--	--	--	106.2	98.0	102.5	101.6
Marquis	92.6	104.2	100.0	100.0	104.6	106.2	97.6	100.0	101.1
S.D. 2280	--	--	--	--	103.4	102.5	97.7	97.8	101.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Regent	97.5	95.7	97.7	103.7	103.5	92.8	102.4	100.0	99.5
Newthatch	--	--	94.3	107.6	100.0	96.4	98.8	98.2	99.2
Ceres	95.3	100.0	95.2	100.0	100.0	98.8	101.2	98.3	98.3
Henry	--	--	--	--	90.0	91.5	89.8	96.8	92.1

Variety State or Nursery No.	Grain Texture, Average								Weighted Average
	1938	1939	1940	1941	1942	1943	1944	1945	
S. D. 2280	--	--	--	--	102.2	104.9	102.2	101.1	102.8
N. No. 1756	--	--	--	--	--	104.8	102.3	101.8	102.4
Pilot	104.6	99.9	97.0	101.2	102.3	103.6	102.3	101.1	101.5
Cadet	--	--	94.4	102.3	101.1	97.6	104.7	102.1	101.4
Mida	--	103.4	97.8	101.1	101.1	104.7	101.2	101.3	100.8
N. No. 1764	--	--	--	--	--	103.8	100.0	100.0	100.6
Rival	99.3	99.0	94.3	101.2	101.1	103.6	102.3	101.6	100.6
Newthatch	--	--	96.6	100.0	101.1	100.0	101.2	100.0	100.4
N. No. 1753	--	--	--	--	--	101.2	99.0	101.1	100.3
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Marquis	91.1	100.3	98.9	100.0	100.0	102.5	100.0	100.0	99.9
Ceres	93.7	103.7	95.3	101.2	98.8	103.7	101.1	99.5	99.7
N. No. 1750	--	--	--	--	--	104.9	97.7	96.9	98.2
Regent	95.9	93.5	93.3	98.9	100.0	96.4	102.3	98.9	98.1
N. 1556	--	--	--	--	--	92.9	98.9	101.1	97.9
Henry	--	--	--	--	98.8	96.4	96.6	96.6	96.9

Variety State or Nursery No.	Summary of all tests for seven properties								Average 7 Properties
	Test Weight	Wheat Protein	Flour Yield	Absorp- tion	Opt. Volume	Crumb Color	Grain Texture	Average 7 Properties	
Cadet	99.3	103.0	99.7	105.3	100.3	105.7	101.4	102.2	
S. D. 2280	103.1	102.9	102.5	101.1	101.0	101.0	102.8	102.1	
Mida	105.4	99.5	102.6	100.4	94.9	107.4	100.8	101.6	
N. 1753	101.8	100.3	97.3	103.7	104.5	101.6	100.3	101.5	
Rival	102.4	99.4	102.7	103.1	98.2	103.5	100.6	101.4	
Newthatch	99.6	105.9	101.4	101.2	101.4	99.2	100.4	101.3	
N. 1764	100.5	100.3	98.4	106.5	99.0	103.7	100.6	101.3	
Regent	100.7	104.3	100.6	100.5	102.0	99.5	98.1	100.8	
N. 1756	104.9	94.9	101.0	99.3	94.3	108.1	102.4	100.7	
N. 1556	101.3	102.4	99.4	102.2	97.8	103.2	97.9	100.6	
Pilot	100.7	98.4	99.1	99.3	100.3	104.2	101.5	100.5	
N. 1750	105.7	98.0	101.1	101.6	90.3	106.5	98.2	100.2	
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
Ceres	101.5	97.7	99.5	101.5	96.7	98.8	99.7	99.3	
Marquis	100.0	95.4	97.0	98.4	95.4	101.1	99.9	99.2	
Henry	102.8	94.5	103.0	99.3	95.3	92.1	96.9	97.8	

### COMPARABLE SAMPLES WITH THATCHER: 1945

In table 12, the properties of the 1945 samples of 15 varieties or strains of hard red spring wheat are compared with those of Thatcher grown in the same tests. The varieties are arranged in order of percentage for the optimum loaf volume.

### COMPARABLE SAMPLES 1933 to 1945

Table 13 gives the averages (3 to 8 years) of the milling, baking, and chemical properties of 15 varieties and strains, expressed as a percentage of comparable samples of Thatcher. These include the leading commercial varieties grown in the region and the most promising new hybrid strains that have been tested. From 13 to 132 comparisons were made for these wheats. The more important quality comparisons were made for these wheats. The more important quality comparisons shown in the summary table 13 discussed in relation to Thatcher as 100 percent.

#### Thatcher

Thatcher has been a uniform variety in the plot experiments since 1932. It was distributed for commercial growing in 1934. It is resistant to stem rust, is early, has short, strong straw and yields well. Its commercial acreage increased rapidly until it became the most widely grown variety in 1938. It probably reached its peak in 1941 when it was grown on about 6 million acres in the United States and 9 or 10 million acres in Canada. Being susceptible to leaf rust, it was injured severely in 1938, 1939, and again in 1941 and its acreage has since decreased in the United States giving way to Rival and Pilot in the leaf-rust-affected sections. Thatcher replaced Marquis as a standard of comparison in 1939 and as it is still the most widely grown hard red spring variety it is here used as the standard of comparison for the different milling and baking properties.

These tests show Thatcher to average about medium in test weight being exceeded by a number of the commercially acceptable varieties. It has shown excellent milling qualities producing a high percentage of flour and somewhat better than would be expected from its test weight. The protein content is medium to high and the flour ash about average as compared with the flour ash from a number of other commercially grown varieties. The quality of the protein is strong. Thatcher has excellent baking qualities in experimental baking tests and is preferred by the grain trade for a strong type bakers' flour. It ranks high in loaf volume of bread, has good grain-texture, satisfactory but only medium crumb color and a reasonably high water absorption. The 1945 correlation coefficient for flour protein-loaf volume was high ( $r=.9095$ ) and the slope of the regression line ( $b_1=48.8 \text{ cc}$ ). In table 13 are summarized the data from 3 to 8 years tests, giving the relative rank of 15 wheats in percentage of Thatcher, for the principal milling and baking properties.

#### Pilot

Pilot has been a uniform variety in plot experiments since 1936 and commercially grown since 1939. It has shown excellent milling and baking qualities in experimental baking tests and is approved by the grain trade for a strong type flour. Pilot is resistant to both stem and leaf rust, to mildew, bunt and some of the footrots. It has been the highest yielding of the uniform varieties during the past 8 years, ranking first in five of the years. It ranked fourth in quality in the Eastern composite and second in the Western composite during the four year period 1942 to 1945 inclusive. The weighted average of 109 comparable samples for 8 years shows Pilot exceeds Thatcher with respect to test weight and average and optimum loaf volume of bread. Pilot has made bread that has averaged (8 years) considerable better than Thatcher in grain texture and crumb color. It has been uniformly low in flour ash content and exceeded many of the uniform varieties in this respect. The quality of the protein of Pilot is good. Pilot averages slightly lower in flour protein content than Thatcher, but is equal to Thatcher in loaf volume of bread for the average of 8 years tests (table 2). Pilot has a short dough mixing time. It averages slightly lower than Thatcher for the other properties. In supplemental baking tests Pilot does not usually respond to increasing amounts of bromate and is easily injured by long fermentation. The dough properties of Pilot are elastic and pliable as contrasted with some varieties which produce bucky doughs. The correlation coefficient for flour protein-loaf volume was high ( $r=.9325$ ) and the slope of the regression line ( $b_1$ ) equals 58.8.

### Rival

Rival was made a uniform variety in 1938 and together with Pilot was distributed for commercial growing in 1939. By 1944 they had increased to 6 million acres, with Rival exceeding Pilot about 3 to 1. Rival has shown good milling and baking qualities in experimental baking tests and is considered satisfactory by the grain trade. Both Pilot and Rival are awned wheats and do not have as strong straw as desired for the heavier soils in the eastern section. Among the uniform varieties Rival has yielded less than Pilot but more than Thatcher during the past 8 years for the region, and has yielded much better in the eastern than in the western sections. The weighted average of 83 comparable samples for 8 years show Rival to exceed Thatcher with respect to test weight, flour yield, water absorption, crumb color and grain texture.

It is among one of the varieties high in flour ash. It has been outstanding as to yield of flour ranking better than most of the varieties and strains grown over a period of years. Of the 16 wheats shown in table 13, it ranks 9th in optimum loaf volume and 5th for the average of 7 principal properties. The correlation coefficient for flour protein-loaf volume was ( $r=.7964$ ) and the slope of the regression line ( $b_1$ ) equals 59.9 was steeper than that of any of the 15 wheats with which it was compared.

### Cadet

Cadet has been a uniform variety for the region for the 4 years 1942 to 1945. It is the result of a Merit x Thatcher cross and was increased in 1944 and distributed for commercial growing in 1945. Cadet is a midseason, awnless wheat resistant to both stem and leaf rusts. It has been a high yielding wheat for the region but appears best adapted to the northern part. During a 6-year period 83 comparable milling and baking tests show it to exceed Thatcher with respect to crude protein content of wheat, water absorption, loaf volume for the No. 6, average, and optimum, crumb color, and grain texture. It is approximately equal to Thatcher in test weight and flour yield, has a higher ash in the flour and a much greater water absorption. Supplemental baking tests show that it responds sharply to increasing amounts of bromate and generally has greater tolerance to long periods of mixing and fermentation than most varieties. It has ranked high by the malt-phosphate-bromate bake used by the North Dakota, and Canadian laboratories. Commercial milling and baking tests for the last 4 years rank it high in quality. Among the 16 wheats it ranks 3rd in crude protein of wheat, 2nd in water absorption, 5th in loaf volume by the No. 6 method and optimum bake, 4th in crumb color, and grain texture and 1st for the average of 7 principal properties. The 1945 correlation coefficient for flour protein-loaf volume was medium high ( $r=.9097$ ) and the slope of the regression line ( $b_1$ ) equals 43.5.

### Mida

Mida was first made a uniform variety for the region in 1944 when it was distributed for commercial growing by the North Dakota Agricultural Experiment Station. It has been in plot experiments at the North Dakota and Minnesota stations for 6 years and was the highest yielding wheat for the region in 1945. It is an awned, strong-strawed wheat, resistant to both stem and leaf rusts and to bunt. During 7 years 68 milling and baking tests show that it exceeds Thatcher with respect to test weight, crude protein of wheat, flour yield, water absorption, crumb color, and grain texture and has a lower ash content of the flour. In loaf volume Mida ranked lower than Thatcher by the No. 6, average, and optimum baking results. It ranked 14th, according to the optimum bake and 13th by the No. 6 and 14th by the average results, among 16 wheats. It averages 3rd in yield of flour and 2nd in crumb color and test weight. The summary of 7 principal properties shows it to rank 3rd. It has commercial trade approval as satisfactory for all-purpose bakers' flour. The correlation coefficient flour protein-loaf volume ( $r$ ) was .8527 and the slope of the regression line ( $b_1$ ) medium, 47.7.

### Regent

Regent has been a uniform variety since 1942. It was developed and distributed by the Canadian Department of Agriculture in 1939 and has been grown commercially in the United States since 1940. It is recommended for growing on the heavier soils of the Red River Valley of Minnesota and North Dakota. In other areas, however, it has been damaged by heat and scab and has not been a high-yielding wheat. It has shown excellent milling and baking qualities in experimental tests and has been approved by the commercial grain trade. Sixty-six comparable tests with Thatcher covering 8 years show it to exceed Thatcher with respect to test weight, crude protein of wheat, flour yield, water absorption, loaf volume for the average, No. 6, and optimum, but lower in other properties. It is higher in ash of flour than Thatcher.

Regent has been particularly high in protein exceeding many of the wheats with which it has been comparably grown. The better loaf volume obtained from Regent indicates that the quality of the protein is also good. It has about the same dough mixing time as Thatcher. Regent averages 8th in the summary of 7 principal properties. The correlation coefficient for flour-protein-loaf volume was ( $r=.9111$ ) and the slope of the regression line ( $b_1$ ) equals 50.0.

#### Newthatch

Newthatch is a composite of several Hope x Thatcher<sup>3</sup> backcross strains, one of which was a uniform variety for the eastern section in 1942. In 1943 Newthatch replaced the single line as a uniform variety for the eastern section and was made a uniform variety for the region in 1944. The variety was distributed to seed growers by the Minnesota Agricultural Experiment Station in 1944. In the Minnesota plot experiments for 5 years, Newthatch has outyielded the other uniform varieties but for the region it is not high. By using yields and milling and baking data for the single lines included in the composite, data are available for a 6-year period. During a 6-year period of 65 comparable milling and baking tests, Newthatch has exceeded Thatcher with respect to crude protein of wheat, flour yield, water absorption, and loaf volume, (No. 6, average and optimum) and grain texture. It has a high ash content, ranking 3rd in comparison with 16 wheats. It has one outstanding advantage in being highest in protein content of the wheat, and averages 3rd in optimum loaf volume among 16 wheats. It is about the same in test weight as Thatcher but yields slightly more flour than Thatcher on a yearly basis for the 6 years compared. The dough mixing time is similar to that of Thatcher. It ranks 6th for the average of 7 principal properties. The 1945 correlation coefficient for flour protein-loaf volume was not as high as some of the other varieties ( $r=.8600$ ) and the slope of the regression line rather low ( $b_1$ ) equals 40.9.

#### Marquis

Marquis was a uniform variety for the region from 1929 to 1942 and is still one of the uniform varieties for the western section. It was the leading spring wheat variety of the United States from 1919 to 1934. It was long considered the standard of quality, but since 1938 has been replaced by Thatcher. Marquis is still held in high regard by the commercial trade, although in comparison with newer varieties it has not shown to advantage in experimental yield and quality tests. It is the lowest yielding of the uniform varieties. Among the 16 wheats, 60 comparable samples of Marquis and Thatcher show Marquis to be lower than Thatcher in flour yield, water absorption, crude protein, loaf volume (No. 6, average and optimum) and grain texture. It is higher than Thatcher for crumb color and also higher in ash content of flour. It ranks 13th for optimum loaf volume and 15th in the summary of the 7 principal properties among the 16 wheats. The correlation coefficients for flour protein-loaf volume was high ( $r=.9407$ ) and the slope of the regression line ( $b_1$ ) equals 52.3.

#### Ceres

Ceres has been a uniform variety since the start of the coordinated regional program in 1929. It was distributed in 1926 and increased rapidly, exceeding Marquis in acreage by 1934. In the bad rust years of 1935, 1937, and 1938 it was severely damaged and was gradually replaced by Thatcher. It is still a high-yielding wheat in most of Montana and other sections where stem and leaf rusts do not occur too frequently. Ceres has consistently shown good milling and baking qualities in experimental tests and has been accepted by the commercial trade. Among the uniform varieties for the western section Ceres has been outyielded by both Thatcher and Pilot. Among the 16 wheats summarized in table 13, 50 comparable samples of Ceres and Thatcher covering 8 years, show Ceres exceeds Thatcher with respect to test weight and water absorption. It averages slightly lower than Thatcher for the other properties but ranks 10th for the No. 6 and average loaf volume and 11th for optimum volume among 16 wheats. It ranks 13th in protein content and 14th for the average of 7 of the principal properties. The correlation coefficient for flour protein-loaf volume was one of the highest ( $r=.9857$ ) and the slope of the regression line medium high ( $b_1$ ) equals 54.4.

N. No. 1764

N. No. 1764 is Merit x Pilot, (C.I. 12315) and was the 2nd highest yielding wheat in the Uniform Regional Nurseries for the 3 years 1943 to 1945. It has been advanced to plot experiments at most stations. It is an early bearded wheat with good strength of straw. It also is resistant to stem and leaf rust, bunt, mildew, and scab. During the last 3 years 32 comparable milling and baking tests show it exceeds Thatcher with respect to test weight, crude protein content, water absorption, crumb color, and grain texture. It has the highest ash content of flour among the varieties compared and the flour yield is relatively low, ranking 14th. It appears to be outstanding on the basis of 3 years results in water absorption ranking 1st among 16 varieties. The dough mixing time is slightly longer than required for Thatcher. It ranks 7th among 16 varieties for an average of 7 principal properties. It appears to be one of the outstanding strains tested during the last 3 years. The correlation coefficient ( $r=.9397$ ) for flour-protein loaf volume was as high as for many of the other comparisons. The slope of the line ( $b_1$ ) was .41.1

N. No. 1756

N. No. 1756 is Pilot x Mida (C.I. 12303) and has been the highest yielding wheat in the Uniform Regional Nursery for 3 years 1943 to 1945 inclusive. It has been advanced to plot tests at a large number of stations because of high yield and heavy test weight kernels. In the plot experiments it has also been high yielding, exceeding the uniform varieties. It is bearded with good straw, does not shatter and is resistant to the rusts and smuts.

During the last 3 years 24 comparable milling and baking tests show it exceeds Thatcher in test weight, flour yield, crumb color, and grain texture. It is outstanding in crumb color ranking highest among 16 wheats. It also has the lowest flour ash of the 16 varieties compared. It averages lower than Thatcher for the other properties and ranks 9th among 16 wheats for an average of 7 principal properties. The correlation coefficient ( $r=.9534$ ) for flour protein-loaf volume was high and the slope of the regression line ( $b_1$ ) equals 46.8 is intermediate.

N. No. 1750

N. No. 1750 is Pilot x Mida (C.I. 12316). It is the 3rd highest yielding wheat in the Uniform Regional Nurseries for the last 3 years. It was advanced to plot experiments at a number of stations because of good yields, strong straw and unusually heavy test weight of grain. It also has good resistance to the rusts and smuts and is one of the most attractive wheats in both the field and bin. In 3 years comparable tests of 24 samples with Thatcher, N. No. 1750 exceeds Thatcher in test weight (ranking 1st. of 16 wheats compared), yield of flour, water absorption, and crumb color of bread. It has a much lower flour ash than Thatcher. It averages lower than Thatcher for all the other properties ranking lowest in loaf volume (optimum bake) of the 16 wheats compared. It was outstanding in test weight but only average in flour yield. The dough mixing time is longer than required for Thatcher. It ranks 12th in protein content, but lowest in loaf volume (all methods) of bread of the 16 wheats compared. It ranks 12th in the summary of 7 principal properties. The correlation coefficient flour protein-loaf volume was low ( $r=.8162$ ) and the slope of the line also low ( $b_1$ ) equals 37.9.

Henry

Henry is the highest yielding wheat in the uniform regional nursery for the 3-year period 1942 to 1944 and was increased and distributed by the Wisconsin Agricultural Experiment Station in 1944. It has also been a high-yielding wheat in Wisconsin experiments and has been tested at Minnesota and South Dakota stations with favorable yield results. During 4 years 20 milling and baking tests show that it exceeds Thatcher with respect to test weight, flour yield, and has one of the lowest ash content of the 16 wheats. Although not the highest in test weight, it yields more flour than any of the wheats with which it was compared. The flour is soft and does not have the granular characteristics of hard wheats. It ranks lower than Thatcher in water absorption, loaf volume of bread by the No. 6, average and optimum bakes. It has a somewhat shorter dough mixing time than Thatcher. It ranks lowest in crumb color, protein content, grain texture and the average of 7 properties of the 16 wheats compared. The correlation coefficient ( $r=.9241$ ) between flour protein and loaf volume was high although the 5 samples were all in the low protein range. The slope of the regression line ( $b_1$ ) equals 35.5 was among the lowest.

S.D. 2280

S. D. 2280 is a beardless selection from a Rival x Thatcher cross, developed at the South Dakota Agricultural Experiment Station. It was tested in the Uniform Regional Nursery for the 3 years, 1942 to 1944, and has been in plot experiments at Brookings for a 5-year period. It is a stiff strawed, early strain which has yielded well in South Dakota experiments.

During 4 years 13 milling and baking tests show that S. D. 2280 exceeds Thatcher with respect to test weight per bushel, protein of wheat, yield of flour, water absorption, loaf volume (No. 6 and optimum), crumb color, and grain texture. It ranks lower than Thatcher in flour ash. The dough mixing time is slightly longer than required for Thatcher. It does not respond to increasing amounts of bromate, requiring approximately half the amount needed for Thatcher for optimum results. These few tests show that it has good grain texture ranking highest among 16 wheats. It ranks fourth in protein, flour yield, loaf volume (No. 6 and optimum) and second in the summary of seven principal properties. No correlation coefficients or regression lines were calculated because of the small number of samples tested.

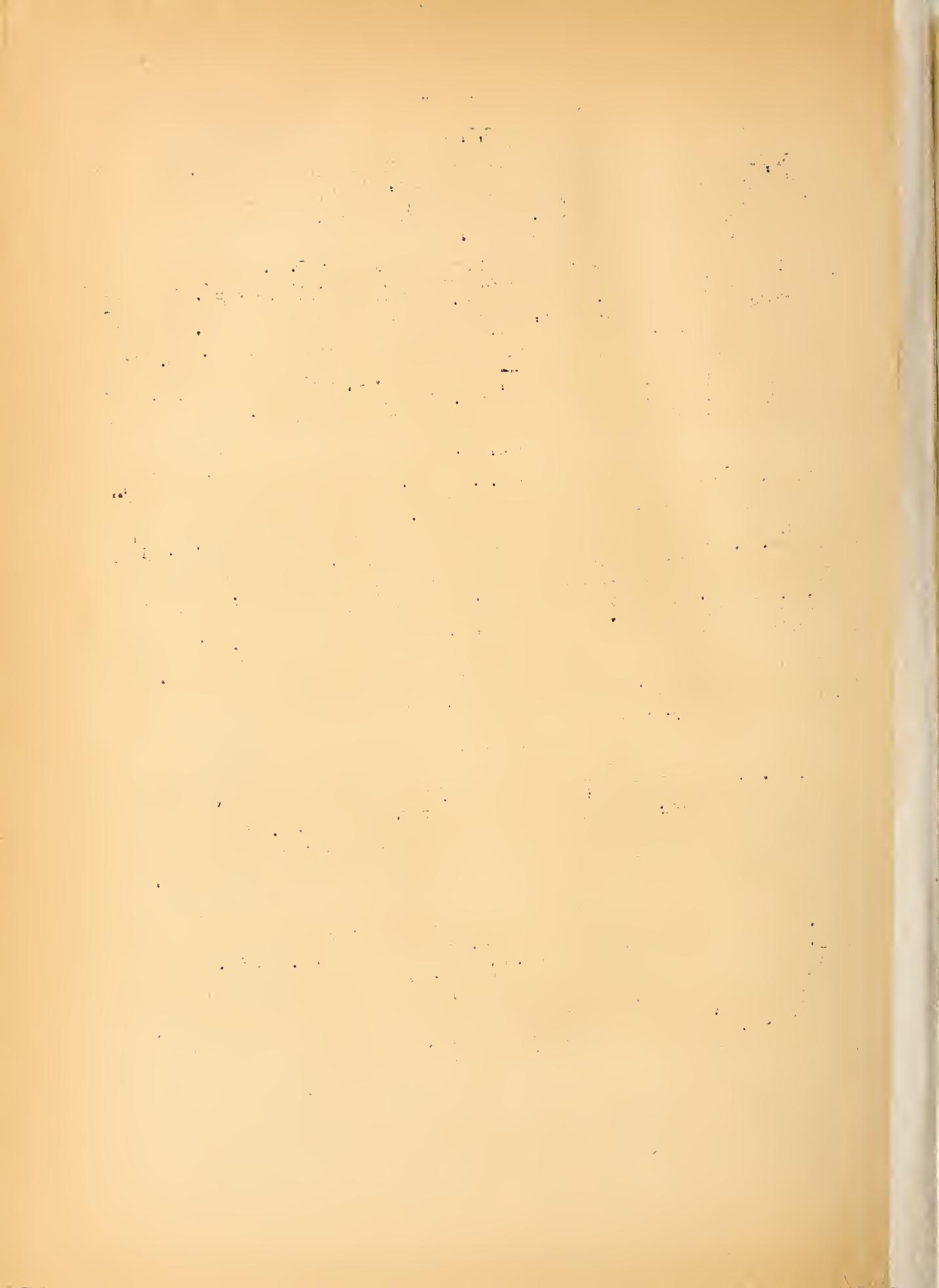
N. No. 1753

N. No. 1753 is Regent x Pilot (C.I. 12317). It has been the highest quality wheat in the Uniform Regional Nursery for the 3 years 1943 to 1945 and has been advanced to plot experiments at several stations. It has yielded about the same as Thatcher, is awnless, and has good straw and resistance to stem and leaf rust, bunt and mildew. It also has an attractive smooth kernel of heavy test weight. In 13 comparable quality tests with Thatcher (for 3 years) N. No. 1753 is equal to or exceeds Thatcher in all properties except flour yield and grain texture and ranks first in No. 6, optimum, and average loaf volume, among 16 wheats discussed. It is equal to Thatcher in flour ash. It handles satisfactory in the mill but the flour yield is low ranking 15th of the 16 wheats compared. Aside from the low flour yield, it is considered one of the most outstanding strains from a quality standpoint. The dough mixing time (only three years results) indicate that it averages slightly less than required for Thatcher. It ranks 4th in the summary of 7 principal properties. The correlation coefficient was one of the lowest ( $r=.6525$ ) and the slope of the line lowest ( $b_1$ ) equals 23.4.

N. No. 1556

N. No. 1556 is an early bearded selection from a Ceres x Hope-Turkey-Florence cross developed at the Dickinson Substation, Dickinson, North Dakota. It was included in the Uniform Regional Nursery for the 3 years 1943 to 1945 where it was the earliest variety in the experiment for 3 consecutive years. It has been in plot experiments at Dickinson for 4 years and at other N. Dak. stations and at some of the more southern stations for shorter periods. Because of its earliness it has yielded best at the more southern stations, particularly in Nebraska.

During the 3 years (1943 to 1945) 13 milling and baking tests show that N. No. 1556 exceeds Thatcher with respect to test weight, protein of wheat, flour yield, water absorption, and crumb color. It is lower than Thatcher with respect to flour, ash, and loaf volumes (No. 6, average and optimum). N. No. 1556 averaged about the same as Thatcher in dough mixing time. It responds well to increasing amounts of bromate requiring for optimum results about three times more bromate than Thatcher. It ranks tenth among 14 varieties for an average of seven principal properties. No correlation coefficient or regression lines were calculated, because of the small number of samples tested.



The bread baking tests on the 1947 samples (same as used on the 1945, and 1946 samples) were made by a rich highly bromated formula.

Details of the methods used in 1947, with the various ingredients shown in table 1.

Table 1.--Baking methods used for samples of the 1947 crop.

Ingredients	Baking Method	
	Commercial-bromate-malted, wheat flour	
Flour (grams)	:	100.0
Yeast (grams)	:	2.0
Salt (grams)	:	1.5
Sugar (grams)	:	5.0
Potassium bromate (grams) <sup>1/</sup>	:	.0 to .004
Malted wheat flour (grams)	:	.25
Nonfat dry milk solids (grams)	:	4.0
Shortening (grams)	:	3.0
Water absorption (percent)	:	Optimum for each variety
Mixing time (minutes)	:	Optimum for each variety
Fermentation time (minutes)	:	180

<sup>1/</sup> 0, 1, 2, 3, and 4 mg.

Fermentation periods:

- 1st. punch after 105 minutes
- 2d punch after additional 50 minutes
- Mold after additional 25 minutes
- Proofing time - 55 minutes
- Baked 25 minutes at 450° F.

This baking procedure is based on the method of the American Association of Cereal Chemists, with certain modifications deemed necessary for unbleached experimentally milled flour. Because of the size of the mixing bowl, ingredients sufficient for two loaves were mixed at one time. They were mixed a sufficient length of time to develop the dough properly in a Hobart-Swans dough-mixer (108 R. P. M.) with 4 pins in the head and 3 pins in the bowl. The absorption of the flour was calculated from the amount of water added for proper consistency at the time the doughs were mixed. The absorption values are indicated in the tables. When mixed, the doughs were divided, then rounded in the hands, and placed in fermentation granite-ware "oatmeal" bowls, measuring 6 inches top diameter, 3 inches bottom diameter, and 2-1/2 inches deep. The punches were made by folding the dough approximately 10 times in the hands. At the end of the fermentation period the dough was molded by a Thompson mechanical roll type "A" moulder with rolls set at a clearance of 3/8 of an inch and the compression plate 1-1/8 inches. The molded doughs were placed in baking pans constructed from 2XX tin known as the tall form. The proofing time of 55 minutes, at 86° F. and baking time of 25 minutes at 450° F. were the same for all samples. Two loaves of each sample were baked, but since the ingredients were mixed as for one loaf, t

the are not duplicates in the sense in which that term is usually used and are not so considered herein. Data given in the tables are averages of the two loaves.

The baking trials were made by varying the amounts of bromate (0 to 4 mg per 100 grams of flour) with the formula given in table 1. With this baking procedure the optimum or maximum loaf volume is apparently obtained with the flour from each variety or strain. It has generally been found that the loaf having the optimum volume also has the best crumb color and grain-texture of the different baking tests made. This test appears to bring out the full strength of the wheats somewhat better than the methods previously used. In actual practice a baking test with 1 milligram and another with 2 milligrams of bromate is made on the same day. Bakes with no bromate or increased amounts of bromate (3 milligrams or higher) are made on the following days until the optimum loaf volume has been determined for each variety or strain. Average volumes are calculated from the three best bakes, only. This baking procedure brings each of the samples to its optimum volume by taking provision for adequate gas production, by the employment of sufficient sugar and diastatic supplements, and sufficient oxidation by the use of increasing amounts of potassium bromate.

A check or standard flour for control purposes was included in the baking trials with each day's tests. The loaf volume for each of the 51 bakes with the standard flour (12.3 percent protein) and the dates on which they were made are shown in the following tabulation:

Date	Volume : cc.	Date	Volume : cc.	Date	Volume : cc.
Nov. 17	718	Feb. 10	761	Mar. 24	778
18	732	11	775	25	778
19	750	12	789	Apr. 1	806
Jan. 5	764	16	784	5	789
6	755	17	709	6	783
7	767	18	754	7	786
12	738	19	720	12	789
13	735	21	769	13	755
14	738	25	772	14	766
15	741	26	787	19	775
19	758	Mar. 1	772	26	755
26	781	2	755	27	758
27	758	3	749	28	766
28	760	4	758	29	761
Feb. 4	755	8	752	May 4	786
5	755	22	778	6	772
9	775	23	769	10	772
				Average	763
				Standard error	19.7

Fifty-one baking tests were made with the standard flour. The average loaf volume was 763 cc. and the standard error 19.7 cc.